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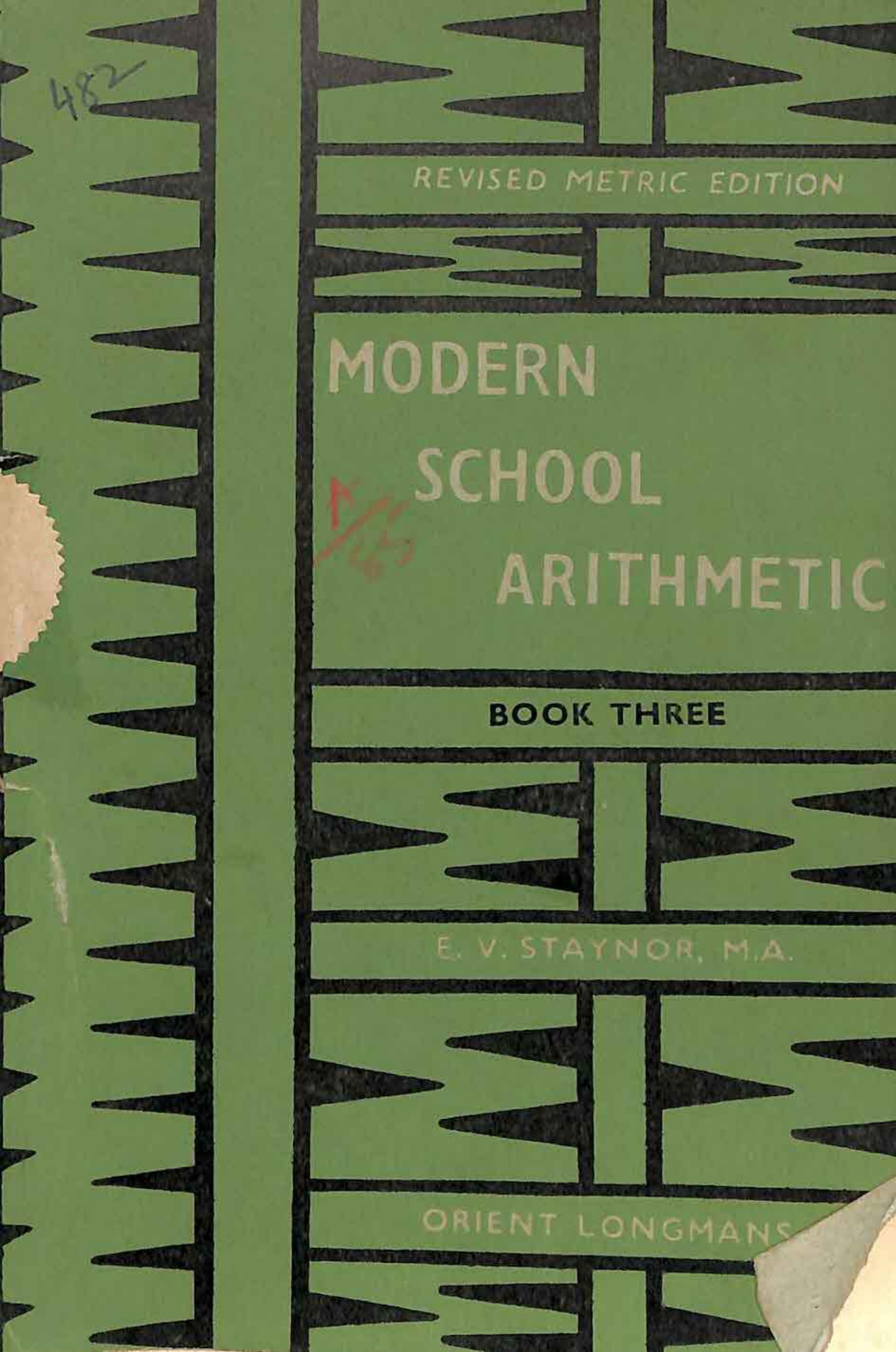

REVISED METRIC EDITION

MODERN SCHOOL ARITHMETIC

BOOK THREE

E. V. STAYNOR, M.A.

ORIENT LONGMANS

482 (35 50)

MODERN SCHOOL ARITHMETIC

REVISED DECIMAL MONEY AND METRIC WEIGHTS AND MEASURES

STATE INSTITUTE OF EDUCATION

BOOK III

A/65

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PREFACE TO REVISED EDITION, 1957

The books of this series are expressly revised to provide for the change-over in India to the decimal money system to take effect from April 1957.

Until 1960 both the old and the new coins will be in circulation. The difficulties arising out of this dual circulation should not, however, affect the children of the age groups, for whom these books are intended to any great extent. All that they need be taught is what they will find directly and personally useful in the conduct of their school and home life. What may be so required by them will be found in the respective last chapters of the Books. The work should be undertaken at suitable stages of the main course.

It should be noted that at first only the four lower denominations of the new coins will be put into circulation. The new quarter-rupee and the half-rupee will be added later. If in the interim their present counterparts are consistently referred to as the quarter-rupee and the half-rupee rather than as the four-anna bit and the eight-anna bit, the way to the adoption of the new system will be made much easier.

The main course in this edition is based on the new money system. The methods used in teaching this system are explained in a booklet published separately.

It is presumed that the teacher will obtain a copy of this booklet. All that need be mentioned here is that until the stage at which Decimals in general (Book 3) is reached, the Naya Paisa is treated as the unit and the Rupee as a hundred units. The pupil is first taught to write his sums in full, e.g. Rs. 5·45 nP. The contraction to Rs. 5·45 is next introduced, the point being referred to as "the naya-paisa point". At these stages, whenever the amounts are written in column form, the "Rs" is placed directly over the figures that represent the number of rupees.

This procedure follows the teaching practice of the countries that already have a decimal monetary system and conforms to that advocated by the Inter-State Board for Anglo-Indian Education in its recent syllabus for the Primary School.

Suggestions, especially those that are the outcome of the experience of teaching the new money system, for the improvement of subsequent editions of this Series will be gratefully received by the author.

I should like to express my thanks to Mr. T. S. Rajagopalan, B.A., L.T., Assistant, Hindu High School, Triplicane, Madras, for his kindness in reading the proofs of these books and for giving many helpful suggestions for the improvement of the text and arrangement of subject matter.

E.V.S.

REVISED EDITION 1962

This edition has been completely revised and enlarged so as to bring the book into line with the syllabus suggested by the Inter-State Board for Anglo-Indian Education.

The metric system of weights and measures have replaced the former Indian and British systems.

New chapters have been introduced on the following :— multiplication and division by factors; prime factors; H.C.F.; L.C.M.; averages; direct and inverse proportion.

The chapters have been rearranged in order that the pupil may get a thorough grasp of each topic before proceeding to the next.

The section in geometry has also been enlarged so as to give the pupil more practice in the use of geometrical instruments.

A number of revision tests have been included at the end of the book.

R. BENTINCK

CONTENTS

PART I

PAGES
ORDER OF SIGNS AND MENTAL ARITHMETIC .. 1
LONG MULTIPLICATION AND DIVISION 3–5
MULTIPLICATION AND DIVISION BY FACTORS .. 7–8

MONEY :

Addition, Subtraction, Multiplication and Division 11–13

THE METRIC SYSTEM

Weights and Measures of Length 13–15
Measure of time 17
Compound Multiplication 19
Problems and Races 20–21
COMPOUND DIVISION : 22
Races, Problems 23
COLUMN GRAPHS 25
BILLS 27
INDIVIDUAL WORK I 28
TENTHS 30
SIXTHS AND TWELFTHS 43–44

FRACTIONS :

Vulgar 45
Improper 47
Mixed Numbers 47
Fractions of Quantities 50
Multiplication 51
Revision Examples on Fractions 52

SHARING 54

CODES AND BRACKETS 56–57

PRIME FACTORS 58

  H.C.F. and L.C.M. 60

AVERAGES 63

THE METHOD OF ONE 65

  Direct 65

  Inverse Proportion 67

AREA :

  Method of Counting of Squares 69

  Area of Rectangles 69

  Harder type 77

  Method of Subtraction 79

SIMPLE EQUATIONS 81

PART II

PRACTICAL GEOMETRY

MEASUREMENT OF ANGLES USING THE PROTRACTOR .. 86

THE REGULAR HEXAGON 89

THE MARINER'S COMPASS 91

SCALE DRAWING USING THE CARDINAL POINTS AND MEASURING OF DISTANCES 93

PERPENDICULARS AND CONSTRUCTION OF TRIANGLES .. 95

  (*a*) Three sides 96

  (*b*) Two angles and a side 98

  Exercises on Construction of right-angled triangles 99

COPYING OF LINES AND FIGURES 101

INDIVIDUAL WORK II 102

MODERN SCHOOL ARITHMETIC

BOOK III

THE ORDER OF SIGNS

Example. $5+6\times 4$ means : *First* multiply 6 by 4, *then* add 5. The answer is 29.

Remember that multiplication must be done *before* addition or subtraction.

Another Example. $40-5\times 6$

$5 \times 6=30$
$40 - 30=10$
The answer is 10.

Exercises 1

(*Write your answers only*)

(1) $7+6\times 4$
(2) $8\times 6-4$
(3) $8\times 6+10$
(4) $11+5\times 8$
(5) $23+6\times 5$
(6) $43+9\times 4$
(7) $43-9\times 4$
(8) $65-8\times 6$
(9) $7\times 6\times 3$
(10) $7+6\times 3$
(11) $7\times 6+3$
(12) $12\times 11-32$

In the following sums the answers are given, but the signs are left out. Fill in the signs.

(13) $7 \times 3 + 2 = 23$
(14) $8 \quad 2 \quad 6 = 20$
(15) $4 \quad 5 \quad 5 = 25$
(16) $4 \quad 5 \quad 5 = 29$
(17) $7 \quad 5 \quad 3 = 32$
(18) $10 \quad 3 \quad 2 = 4$
(19) $20 \quad 3 \quad 3 = 29$
(20) $12 \quad 3 \quad 7 = 43$
(21) $8 \quad 12 \quad 4 = 56$
(22) $9 \quad 12 \quad 8 = 100$
(23) $12 \quad 13 \quad 5 = 30$
(24) $11 \quad 6 \quad 16 = 50$
(25) $13 \quad 5 \quad 4 = 33$
(26) $13 \quad 2 \quad 5 = 31$
(27) $75 \quad 8 \quad 9 = 3$

y is written in place of the missing number. Find y.

(28) $5+y+8=20$
(29) $10-y+6=14$
(30) $3\times y=21$
(31) $3+y=21$
(32) $5\times y+2=17$
(33) $3\times y-2=16$

Exercises 2

Close your books. Teacher will call out these sums one at a time. When teacher says "down", take up your pencils and write down your answers only.

(1) $95-80$
(2) $96-70$
(3) $105-60$
(4) $83-60$
(5) $83-50$
(6) $87-40$
(7) $76-20$
(8) $56-10$
(9) $120-90$
(10) $127-80$
(11) $136-20$
(12) $145-30$

(13) $85-35$
(14) $76-26$
(15) $67-27$
(16) $92-12$
(17) $93-33$
(18) $78-38$
(19) $128-28$
(20) $128-48$
(21) $123-33$
(22) $135-45$
(23) $136-36$
(24) $137-87$

(25) $72-20$
(26) $83-23$
(27) $65-30$
(28) $65+30$
(29) $73-43$
(30) $73+50$
(31) $72+40$
(32) $123-43$
(33) $83-50$
(34) $83+50$
(35) $67+40$
(36) $67-47$

RACES 1

Fill in the Blanks

(Only answers to be written)

(i)

(*a*) $35\times6+1=..$
(*b*) $25\times5-1=..$
(*c*) $37+25+63=..$
(*d*) $353-298=..$
(*e*) $736-..=378$

(ii)

(*a*) $85+..=144$
(*b*) $95\div4=..$
(*c*) $..\div8=21$
(*d*) $..+63=101$
(*e*) $..\times9=207$

(iii)

(*a*) $13\times7-..=20$
(*b*) $8\times6=..\times3$
(*c*) $815-377=..$
(*d*) $823-..=375$
(*e*) $17\times6+..=105$

(iv)

(*a*) $17+6+..=63$
(*b*) $19+19-..=20$
(*c*) $..\div9=343$
(*d*) $8\times9=..+12$
(*e*) $288\div..=6$

Example. 783×695

$$\begin{array}{r@{\qquad}r}
783 & \\
695 & \\
\hline
469800\ \ .\ \ .\ \ . & 600 \text{ times} \\
70470\ \ .\ \ .\ \ . & 90 \text{ times} \\
3915\ \ .\ \ .\ \ . & 5 \text{ times} \\
\hline
544185 & 695 \text{ times} \\
\hline
\end{array}$$

Exercises 3

	(*a*)	(*b*)		(*a*)	(*b*)
(1)	725 × 689;	× 936	(6)	8356 × 634;	× 6347
(2)	803 × 576;	× 506	(7)	8091 × 407;	× 8069
(3)	937 × 508;	× 753	(8)	7006 × 756;	× 7003
(4)	764 × 307;	× 999	(9)	9380 × 908;	× 8354
(5)	802 × 675;	× 806	(10)	8970 × 835;	× 8035

In a multiplication sum the number by which we multiply is called the **multiplier.** In the example on top of this page 695 is the multiplier. The number which is multiplied is called the **multiplicand;** 783 is the multiplicand. The answer is called the **product** of the two numbers.

Now the product of 4 and 5, for example, is the same as the product of 5 and 4. So, when we have to multiply two numbers, we may make either of them multiplier and the other multiplicand.

Examples. 73×3256

(i)

$$\begin{array}{r}
73 \\
3256 \\
\hline
219000 \\
14600 \\
3650 \\
438 \\
\hline
237688 \\
\hline
\end{array}$$

(ii)

$$\begin{array}{r}
3256 \\
73 \\
\hline
227920 \\
9768 \\
\hline
237688 \\
\hline
\end{array}$$

We see that the work is shorter if we make the smaller number the multiplier.

Exercises 4

(1) 57×6207
(2) 7356×68
(3) 34×8095
(4) 363×2584
(5) 975×63057
(6) 904×678
(7) 903×60078
(8) 506×609
(9) 579×6387

Examples.

$$\left.\begin{array}{l}\text{(i)}\quad 73\times 60\\ = 4380\end{array}\right\}\ \times 6 \text{ and add a 0 on the right.}$$

$$\left.\begin{array}{l}\text{(ii)}\quad 73\times 600\\ =43800\end{array}\right\}\ \times 6 \text{ and add 00 on the right.}$$

$$\left.\begin{array}{l}\text{(iii)}\quad 73\times 50+18\\ = 3650+18\\ = 3668\end{array}\right\}\ \text{First } 73\times 50\text{; then add 18.}$$

Exercises 5

(*Write answers only*)

(1) 85×40
(2) 83×70
(3) 614×50
(4) 712×90
(5) 805×30
(6) 85× 300
(7) 64×2000
(8) 751× 600
(9) 807×5000
(10) 718× 700
(11) 60×751
(12) 600×834
(13) 5000× 76
(14) 300×400
(15) 80×634

(*Show your work as in Example iii*)

(16) 85×30+ 6
(17) 85×30+26
(18) 35×70−35
(19) 63+90× 9
(20) 93×80−21
(21) 73× 400+ 5
(22) 83× 600+75
(23) 96×4000+40
(24) 32×6000−45
(25) 53× 700− 6
(26) 40× 76+25
(27) 600× 76+35
(28) 70× 30+62
(29) 70×535−12
(30) 80×707−45

(i) Dividing by numbers ending in 0.

Examples.

(*a*) 150÷30

$$\begin{array}{r} 5 \\ 3\cancel{0})\overline{15\cancel{0}} \end{array}$$

First cross out the '0's in the unit places.

Then divide by 3.

(*b*) 728÷40

$$\begin{array}{r} 18;\text{rem. }8 \\ 4\cancel{0})\overline{72\cancel{8}} \end{array}$$

First cross out the 8 and the 0 in the unit places. This leaves 8 units over. Then divide by 4.

(*c*) 795÷40

$$\begin{array}{r} 19;\text{rem. }35 \\ 4\cancel{0})\overline{79\cancel{5}} \end{array}$$

First cross out the 5 and the 0 in the unit places. This leaves 5 units over. Then divide by 4. 3 tens are now over. So altogether 35 remains over.

Exercises 6

(1) 720÷30
(2) 725÷30
(3) 840÷70
(4) 853÷70
(5) 876÷70
(6) 3400÷40
(7) 3847÷60
(8) 3857÷60
(9) 3857÷90
(10) 6427÷50
(11) 6780÷80
(12) 6885÷80

(i) Dividing by numbers that do not end in 0.

967÷26

(*d*)

$$\begin{array}{r} 3\ 7;\text{rem. }5 \\ 26)\overline{9\ 6\ 7} \\ 7\ 8 \\ \hline 1\ 8\ 7 \\ 1\ 8\ 2 \\ \hline 5 \end{array}$$

First Step.

2 goes into 9, 4 times. Don't set down 4. First try it. 26×4 =104. So 4 is too much. Next try 3. 3 will do.

Second Step.

2 goes into 18, 9 times. Try 9. 9 is too much. Next try 8. 8 won't do. Try 7.

(*e*) 4363÷87

$$\begin{array}{r} \textit{Ans.}\ \ 5\ 0;\text{rem. }13 \\ \hline 87)\ 4\ 3\ 6\ 3 \\ 4\ 3\ 5\ \ \ \\ \hline 1\ 3 \end{array}$$

$87\times5=435$ will do. Notice where 5 is put. 8 into 1 won't go. So put down 0.

(*f*) 8096÷29

$$\begin{array}{r} \textit{Ans.}\ \ 2\ 7\ 9;\text{rem. }5 \\ \hline 2\ 9)\ 8\ 0\ 9\ 6 \\ 5\ 8\ \ \ \ \ \ \\ \hline 2\ 2\ 9\ \ \ \\ 2\ 0\ 3\ \ \ \\ \hline 2\ 6\ 6 \\ 2\ 6\ 1 \\ \hline 5 \end{array}$$

First step.

2 goes into 8 four times. Try 4. 4 won't do. Next try 3. 3 won't do. Try 2. 2 will do.

Second Step.

2 goes into 22 *at most* 9 times. Try 9. 9 won't do. Try 8. 8 won't do. Try 7. 7 will do.

Third Step.

2 goes into 26 *at most* 9 *times.* Try 9. The remainder is 5.

Exercises 7

	(*a*)	(*b*)	(*c*)	(*d*)
(1)	655÷32;	÷34;	÷21;	÷23
(2)	864÷21;	÷30;	÷23;	÷42
(3)	809÷41;	÷50;	÷29;	÷81

	(*a*)	(*b*)	(*c*)
(4)	6548÷60;	÷65;	÷73
(5)	8548÷65;	÷57;	÷89
(6)	9610÷17;	÷19;	÷37

Division undoes multiplication.

$$7\times8=56;\quad 56\div7=8;\quad 56\div8=7$$

Check the following by division.

(*a*) $37\times56=2072$
(*b*) $89\times54=4806$
(*c*) $62\times73=4526$

(*d*) $60\times70=4200$
(*e*) $57\times49=2793$
(*f*) $90\times80=7200$

Multiplication of numbers by Factors

Example 1. Multiply 36 by 15.

The factors of 15 are 3 and 5.

We therefore first multiply 36 by 3.

The result is 108; we then multiply 108 by the other factor 5. The result is 540.

$$\begin{array}{r} 36 \\ 3 \\ \hline 108 \\ 5 \\ \hline 540 \\ \hline \end{array}$$

You can check your answer by multiplying first by 5 and the result by 3. The result is 540 as before.

$$\begin{array}{r} 36 \\ 5 \\ \hline 180 \\ 3 \\ \hline 540 \\ \hline \end{array}$$

Example 2. 72×854.

We take 72 as the multiplier.

The factors of 72 are 9 and 8.

$$\begin{array}{r} 854 \\ 8 \\ \hline 6832 \\ 9 \\ \hline 61488 \\ \hline \end{array} \qquad \text{or} \qquad \begin{array}{r} 854 \\ 9 \\ \hline 7686 \\ 8 \\ \hline 61488 \\ \hline \end{array}$$

Exercises 8

1. Multiply 47 by 18 in two ways : (*a*) By using the factors 3 and 6. (*b*) By using the factors 9 and 2

2. Multiply 84 by 24 in two ways by using different factors for 24 in each case.

3. Multiply 36×63 in two ways : (*a*) By taking 36 as the multiplier. (*b*) By taking 63 as the multiplier.

Find the products in these multiplication sums.

	(*a*)	(*b*)	(*c*)	(*d*)
4.	26 × 21	70 × 59	112 × 36	45 × 234
5.	43 × 15	54 × 23	125 × 48	72 × 781
6.	64 × 77	29 × 72	379 × 32	63 × 862
7.	87 × 40	33 × 49	851 × 84	59 × 160
8.	36 × 17	58 × 81	765 × 44	47 × 108
9.	91 × 27	75 × 24	896 × 54	67 × 144
10.	42 × 43	84 × 30	777 × 55	43 × 121

Problems

1. 24 beds are needed in a boarding school. If each bed costs Rs. 128, what is the total cost ?

2. An aeroplane goes 455 Km. in one hour. How far will it go in 18 hours ?

3. A book has 115 pages and on each page are 27 lines. How many lines are there in the whole book ?

4. A merchant buys 32 carpets at Rs 124 each and 27 carpets at Rs. 79 each. What is the total amount the merchant pays for the carpets ?

5. A merchant buys 24 electric kettles for Rs. 1,512 and sells them at Rs 64 each. How many rupees profit did he make ?

Division by factors (no remainders)

Example. 1. Divide Rs 112 into 14 equal shares.

The factors of 14 are 2 and 7.

Divide Rs 112 into two equal parts of Rs 56.

Then divide Rs 56 into 7 equal parts.

```
2)112
7) 56
    8
```

If you divide by 7 first, and then by 2, you should get the same result.

```
7)112
2) 16
    8
```

Exercises 9

Find the quotients in the following :

1. 136 ÷ 15
2. 396 ÷ 36
3. 621 ÷ 27
4. 546 ÷ 42
5. 1176 ÷ 56
6. 726 ÷ 22
7. 756 ÷ 63
8. 720 ÷ 48
9. 1008 ÷ 21
10. 1206 ÷ 18

Division by factors with remainder

Example 1. 50÷15 Factors of 15 are 3 and 5.

Take 50 sticks and tie them into bundles of three each. How many bundles will there be ? We will have 16 bundles and 2 sticks left over.

$$\begin{array}{l} 3\underline{)50} \\ \;\;16 \text{ rem. } 2 \end{array}$$

Now take these 16 bundles and group them into fives, you will have 3 groups of 5 bundles each and one bundle cf 3 sticks léft over.

$$\begin{array}{l} 5\underline{)16} \\ \;\;\;3 \text{ rem. } 1 \end{array}$$

So, the number of sticks left altogether is 1 bundle of 3 plus the 2 sticks left over at the beginning. So we have 5 single sticks left over altogether.

Putting the working together we have,

$$\begin{array}{ll} 3\underline{)50} & \text{(16 bundles of three's and 2 sticks left over)} \\ 5\underline{)16} \text{ rem. } 2 & \\ \;\;\;3 \text{ rem. } 1 & \text{(3 groups of 5 bundles each and 1 bundle of 3 left over)} \end{array}$$

Remainder $1 \times 3 + 2 = 3 + 2 = 5$

Ans. 3, rem. 5

Example 2. 426÷24. Factors of 24 are 4 and 6.

$$\begin{array}{l} 4\overline{)426} \\ 6\overline{)106} \text{ rem. } 2 \\ \quad 17 \text{ rem. } 4 \qquad \text{(Four bundles of four)} \\ \qquad\qquad\qquad\quad \text{that is } 4\times4. \end{array}$$

The total remainder is $4\times4+2=16+2=18$.

Ans. 17 rem. 18.

We can now make a rule to find the total remainder. Multiply the second remainder by the first divisor and then add to the result the first remainder.

Example 3. 769÷63 ($63=7\times9$)

$$\begin{array}{l} 7\overline{)769} \\ 9\overline{)109} \text{ rem. } 6 \\ \quad 12 \text{ rem. } 1 \end{array}$$

Second rem. is 1. First divisor is 7.

First rem. is 6.

So total remainder is 1×7 plus $6=7+6=13$.

Exercises 10

	(*a*)	(*b*)	(*c*)
1.	278 ÷ 15	456 ÷ 20	4587 ÷ 33
2.	479 ÷ 18	873 ÷ 21	6492 ÷ 48
3.	581 ÷ 24	635 ÷ 45	8312 ÷ 21
4.	734 ÷ 35	1122 ÷ 35	7659 ÷ 42
5.	853 ÷ 32	1827 ÷ 63	8999 ÷ 72

6. A wire of 347 metres is divided into 18 pieces of equal length. What is the length of the remaining piece of wire ?

7. There are 371 oranges. I put them into baskets which can only hold 18 oranges each. How many baskets can I fill and how many will be left over ?

8. I have Rs 623 and I buy cricket bats which cost Rs 36 each. How many bats can I buy and how much money will I have left ?

9. A boy has 278 marbles. He puts them into bags each containing 28 marbles. How many bags will he need and how many marbles will be left over ?

10. A person has Rs 285. He buys tables at Rs 27 each. How many tables can he buy and how much will he have left ?

MONEY

Addition and Subtraction

Exercises 11

Add :

1. Rs
533.76
278.32
437.69

2. Rs
825.64
709.45
916.38

3. Rs
270.47
736.33
825.68

4. Rs
268.35
426.37
305.18

5. Rs
679.34
253.47
863.99

6. Rs
708.06
425.90
647.85

Subtract :

7. Rs.
426.47
215.52

8. Rs
576.34
285.58

9. Rs
706.05
277.68

10. Rs
800.94
547.68

11. Rs
970.60
326.25

12. Rs
10,000.00
674.23

13. Add : Rs 176.23, Rs 256.07 and 35 nP.
14. Subtract Rs 235.40 from Rs 400.00.
15. From Rs 1,000 take Rs 707.85.
16. Add : Rs 825.63, 73 nP and Rs 8,746.35.
17. How much more is Rs 716.25 than Rs 626.75 ?
18. Add : Rs 315.63 to Rs 513.77 and take Rs 625.83 from your answer.
19. Subtract Rs 826.34 from Rs 1,715.55 and add your answer to Rs 724.33.
20. How much must be added to Rs 667.85 in order to have a total of Rs 767.42 ?

Multiplication and Division

Example.

$$\begin{array}{r r}
\text{Rs} & \\
273.24 \times 37 & \\
37 & \\
\hline
8197.20 & \times 30 \\
1912.68 & \times 7 \\
\hline
10109.88 & \times \overline{37} \\
\hline
\end{array}$$

Ans. Rs 10,109.88

Exercises 12

		(*a*)	(*b*)	(*c*)	(*d*)
1.	Rs 382.45	× 6	× 7	× 8	× 9
2.	Rs 275.36	× 10	× 11	× 12	× 16
3.	Rs 38.58	× 23	× 40	× 47	× 58
4.	Rs 91.47	× 62	× 75	× 83	× 49
5.	Rs 84.06	× 56	× 70	× 47	× 84
6.	Rs 137.43	× 24	× 33	× 57	× 68
7.	Rs 256.05	× 42	× 40	× 59	× 68
8.	Rs 310.48	× 37	× 45	× 57	× 69
9.	Rs 557.60	× 50	× 27	× 38	× 49
10.	Rs 409.07	× 24	× 35	× 46	× 57

Exercises 13

(Revision in Division)

		(*a*)	(*b*)	(*c*)	(*d*)
1.	Rs 151.20	÷ 3	÷ 5	÷ 7	÷ 9
2.	Rs 403.20	÷ 4	÷ 6	÷ 8	÷ 10
3.	Rs 880.80	÷ 5	÷ 8	÷ 12	÷ 16
4.	Rs 7257.60	÷ 4	÷ 6	÷ 8	÷ 16
5.	Rs 5184.00	÷ 8	÷ 10	÷ 12	÷ 16
6.	Rs 7761.60	÷ 7	÷ 9	÷ 10	÷ 11
7.	Rs 9609.60	÷ 3	÷ 11	÷ 12	÷ 16

THE METRIC SYSTEM

Weights : Addition and Subtraction

In India the metric system is now used by the railways, post offices and in shops.

Weight. The unit of weight in the metric system is 1 gram (gm)

10 grams = 1 Dekagram (Dg.)
10 Dekagrams = 1 Hectogram (Hg.)
10 Hectograms = 1 Kilogram (Kg.)
1000 grams = 1 Kilogram

The units most commonly used are Kilograms and grams.

Examples :

Add :

Kg	Hg	Dg	gm
3	4	5	6
4	7	8	9
8	6	5	2
3	4	1	8
20	3	1	5

Ans. 20 Kg 3 Hg 1 Dg 5 gm

Subtract :

Kg	Hg	Dg	gm
8	3	2	1
5	8	8	6
2	4	3	5

Ans. 2 Kg. 4 Hg 3 Dg 5 gm

Addition and Subtraction

Exercises 14

Add :

Kg	Hg	Dg	gm
8	4	5	6
7	9	3	2
5	6	9	8
4	1	5	3

Kg	Hg	Dg	gm
6	5	4	3
3	7	9	8
4	5	6	7
2	7	9	6

Kg	Hg	Dg	gm
7	0	8	9
5	7	0	6
4	3	8	0
6	4	9	8

Kg	Hg	Dg	gm
10	0	5	6
11	7	0	4
15	0	6	7
0	8	4	9

Kg	Hg	Dg	gm
0	6	0	4
19	0	8	0
7	4	9	9
28	0	0	7

Kg	Hg	Dg	gm
12	5	0	4
8	0	7	0
0	6	0	9
35	0	8	8

Subtract :

Kg	Hg	Dg	gm
8	7	4	5
6	3	2	4

Kg	Hg	Dg	gm
6	4	3	2
4	9	7	8

Kg	Hg	Dg	gm
8	0	5	4
4	3	8	7

Kg	Hg	Dg	gm
6	7	0	4
3	8	7	8

Kg	Hg	Dg	gm
18	0	5	4
14	8	8	9

Kg	Hg	Dg	gm
26	9	4	0
13	8	7	8

Kg	Hg	Dg.	gm
8	4	0	3
3	6	0	5

Kg	Hg	Dg	gm
12	0	0	7
7	4	5	8

Kg	Hg	Dg	gm
23	7	0	6
15	9	8	9

Kg	Hg	Dg	gm
7	8	0	0
4	9	8	7

Measures of Length

The unit of length in the metric system is 1 metre.

All distances in India are now measured in metres and Kilometres.

10 millimetres (mm) = 1 centimetre (cm)
10 centimetres = 1 decimetre (dm.)
10 decimetres = 1 metre (m.)
10 metres = 1 Dekametre (Dm.)
10 Dekametres = 1 Hectometre (Hm.)
10 Hectometres = 1 Kilometre (Km.)

The metric measures of length most commonly used in everyday life are millimetre, centimetre, metre and Kilometre.

100 centimetres = 1 metre
1000 metres = 1 Kilometre

Add :

m	cm	mm
5	84	7
4	36	4
9	45	5

m	m	mm
7	8	6
15	27	4
29	48	6

m	cm	mm
16	48	5
28	94	3
47	7	6
22	19	2

Km	m	cm	mm
6	105	24	8
4	213	39	3
7	98	44	5
5	877	85	9

Km	m	cm	mm
7	465	85	9
9	325	43	5
11	616	37	3
14	789	21	4

Km	m	cm	mm
14	9	9	4
16	79	32	5
47	356	44	6
85	801	52	9

Subtract :

m	cm	mm
4	84	6
2	39	4

m	cm	mm
8	47	4
7	31	9

m	cm	mm
37	42	6
19	87	9

m	cm	mm
47	35	8
39	98	9

m	cm	mm
48	5	4
29	59	7

m	cm	mm
57	7	3
38	79	8

Km	m	cm
72	496	72
48	379	49

Km	m	cm
64	354	67
37	175	89

Km	m	cm
89	275	43
45	649	85

Km	m	cm
71	85	79
52	479	93

Exercises 15

To measure small lengths we use the centimetre and millimetre.

Remember 10 mm = 1 cm.

7 cm. 5 mm. is written as 7.5 cm.

5 cm. 8 mm. is written as 5.8 cm.

1. Using your ruler draw lines of the following lengths: 5 cm., 6.4 cm., 8.7 cm., 49 mm., 82 mm., 6.1 cm., 71 mm., 92 mm.

2. Using your compasses draw circles with the following radii : (*a*) 4.2 cm. (*b*) 31 mm. (*c*) 2.3 cm. (*d*) 29 mm.

3. Draw rectangles to the following measurements :

length 5.7 cm.	breadth 3.9 cm.
length 6.3 cm.	breadth 45 mm.
length 82 mm.	breadth 54 mm.
length 63 mm.	breadth 3.9 cm.
length 9.2 cm.	breadth 47 mm.

4. Draw the following triangles :

AB = 7 cm. BC = 6 cm. CA = 5 cm.
AB = 62 mm. BC = 8 cm. CA = 7.5 cm.
AB = 50 mm. BC = 60 mm. CA = 60 mm.
AB = 60 mm. BC = 80 mm. CA = 10 cm.
AB = 55 mm. BC = 55 mm. CA = 71 mm.
AB = 42 mm. BC = 6.1 cm. CA = 4.2 cm.
AB = BC = CA = 58 mm.
AB = BC = CA = 7.1 cm.

Addition and Subtraction

Example 1.

$$\begin{array}{rrrr} & \text{hr.} & \text{min} & \text{sec.} \\ & 5 & 35 & 42 \\ + & 6 & 42 & 35 \\ + & 7 & 50 & 54 \\ \hline & 20 & 9 & 11 \quad \textit{Ans.} \\ \hline & 2 & 2 & 131 \\ & 18 & 127 & \\ \hline & 20 & 129 & \end{array}$$

$$\begin{array}{r} 2\text{ hr.} \\ 6\cancel{0})\overline{12\cancel{9}} \end{array} \qquad \begin{array}{r} 2\text{ min.} \\ 6\cancel{0})\overline{13\cancel{1}} \end{array}$$

9 min. over 11 sec. over.

Example 2.

$$\begin{array}{rrrr} & \text{hr.} & \text{min.} & \text{sec.} \\ & 15 & 25 & 36 \\ - & 10 & 33 & 42 \\ \hline & 4 & 51 & 54 \quad \textit{Ans.} \\ \hline & 15 & 85 & 96 \\ - & 11 & 24 & 42 \\ \hline & 4 & 51 & 54 \end{array}$$

Exercises 16

1. Add. :

(*a*)

hr.	min.	sec.
4	17	28
7	28	35
10	0	56

(*b*)

hr.	min.	sec.
7	58	26
6	32	32
11	23	57

(*c*)

hr.	min.	sec.
9	29	39
3	38	58
12	23	22

2. Subtract :

(*a*)

hr.	min.	sec.
12	40	20
10	45	15

(*b*)

hr.	min.	sec.
14	15	0
6	10	25

(*c*)

hr.	min.	sec.
27	13	11
13	17	27

3. Add : (*a*) 3 hr. 14 min. 26 sec.; 14 hr. 25 min. 30 sec.; 20 hr. 37 min. 4 sec.

(*b*) 12 hr. 15 min. 31 sec.; 27 hr. 20 min. 43 sec.; 15 hr. 33 min. 22 sec.

(*c*) 15 hr. 24 min. 30 sec.; 17 hr. 59 min. 14 sec.; 18 hr. 41 min. 27 sec.

4. From 18 hr. 44 min. 13 sec. take 10 hr. 50 min. 40 sec.

5. Take 13 hr. 20 min. 10 sec. from 20 hr.

6. One train takes 3 hr. 20 min. to do a certain journey. Another train takes 4 hr. 10 min. If they start the journey at the same time, how much earlier will the first train arrive at the end of the journey ?

7. A boy times the school bus that takes him from his house to school. He finds that it takes 4 min. 40 sec. from the house to a cinema which is on the way and then 3 min. 39 sec. from the cinema to the school. What time does the bus take to do the distance from the house to the school ?

Length, time and weight

Example 1.

m.	cm.	mm.
5	21	8
		×8
41	74	4

$8\times8=64$ mm. $=6$ cm. 4 mm.
$8\times21=168$ cm. $=1$ m. 68 cm.
68 cm. $+6$ cm. $=74$ cm.

$5\times8=40$ m.
40 m. $+1$ m. $=41$ m.

The multiplication is the same as multiplying

$$\begin{array}{r}5,21,8\\8\\\hline41,74,4\\\hline\end{array}$$

Ans. 41 m. 74 cm. 4 mm.

Example 2.

Kg.	Hg.	Dg.	gm.
7	9	6	5
			×7
55	7	5	5

Same as

$$\begin{array}{r}7\,9\,6\,5\\\times7\\\hline55,755\\\hline\end{array}$$

Ans. 55 Kg. 7 Hg. 5 Dg. 5 gm.

Example 3.

hr.	min.	sec.	
12	32	27	
		×8	
100	19	36	*Ans.*

$$\begin{array}{r}4\\96\\\hline100\end{array}\qquad\begin{array}{r}3\\256\\\hline25\cancel{9}\end{array}\qquad\begin{array}{r}216\end{array}$$

$$\begin{array}{r}3\text{ min.}\\6\cancel{0}\overline{)21\cancel{6}}\text{ sec.}\\18\\\hline36\text{ sec.}\end{array}$$

$$\begin{array}{r}4\text{ hr.}\\6\cancel{0}\overline{)25\cancel{9}}\text{ min.}\\24\\\hline19\text{ min.}\end{array}$$

Exercises 17

1.	8 m. 64 cm. 9 mm.	× 8; × 7; × 9
2.	4 m. 31 cm. 3 mm.	× 9; × 6; × 5
3.	7 m. 49 cm. 7 mm.	× 9; × 11; × 12
4.	18 m. 61 cm. 8 mm.	× 12; × 9; × 7
5.	42 hr. 42 min. 42 sec.	× 4; × 6; × 8
6.	31 hr. 16 min. 18 sec.	× 5; × 7; × 9
7.	36 hr. 23 min. 49 sec.	× 9; × 12; × 10
8.	12 Kg. 5 Hg. 7 Dg. 8 gm	× 4; × 10; × 6
9.	15 Kg. 6 Hg. 8 Dg. 9 gm	× 9; × 10; × 12
10.	25 Kg. 9 Hg. 7 Dg. 4 gm	× 7; × 8; × 11
11.	45 Kg. 526 gm	× 4; × 7; × 9
12.	32 l. 48 cl.	× 4; × 5; × 6
13.	48 l. 79 cl.	× 6; × 8; × 11
14.	79 l. 87 cl.	× 8; × 10; × 12
15.	46 Km. 872 m.	× 4; × 6; × 7
16.	88 Km. 735 m.	× 7; × 10; × 12
17.	72 Km. 924 m.	× 6; × 8; × 10
18.	25 hr. 38 min. 28 sec.	× 12; × 13; × 16
19.	8 m. 64 cm. 7 mm.	× 11; × 12; × 10
20.	15 Kg. 395 gm	× 10; × 12; × 16

Problems

1. In a time table the following timings are given for a train. (*'a'* stands for arrival ; *'d'* for departure ; the numbers stand for the time of the day.)

	(*a*)	(*d*)		(*a*)	(*d*)
Station A.		7-15	Station C.	8-37	8-42
Station B.	7-50	8-05	Station D.	9-12	

How long does the train halt at B ? How long at C ? How long is the train actually on the run between A and D ?

482

2. School starts at 8.40 a.m. and ends at 1.30 p.m. If there is a 15-minute interval at 10.25 a.m., how long are the classes altogether ?

3. A train leaves Delhi at 6.50 a.m. and arrives Allahabad at 4.45 p.m. How long does the journey take ?

4. A train leaves Madras at 11.32 a.m. and arrives at Bangalore at 7.57 p.m. How long does the journey take ?

5. What length of material is needed to make 8 curtains 3 m. 35 cm. long if 9 cm. are allowed for the hems of each curtain ?

6. An iron pipe is 5 metres 62 cm. long. If 12 such pipes are joined together what will be the total length if 36 cm. are allowed for the joints ?

7. From a box containing 21 Kg. 125 gm. of rice 2 Kg. 240 gms are put into each of 9 bags. How much will be left ?

8. From a barrel containing 276 l. 75 cl. of water I fill 12 tins each of which holds 21 l. 15 cl. How much water will be left in the barrel ?

9. A small truck can safely carry a load of 600 Kg. Can 12 boxes each weighting 47 Kg. 225 gms be carried by the truck ?

10. A passenger travelling by air is allowed to take with him luggage weighting 2 Kg. free of charge. A passenger brings with him two suit-cases, one weights 12 Kg. 965 gm and the other 15 Kg. 740 gm. For what weight of luggage will he be charged ?

Races

(*Write your answers only*)

(i)	(ii)
(*a*) Rs 11.75×2.	(*a*) 4 hr 8 min. ×8.
(*b*) 3706÷12.	(*b*) 8615÷30.
(*c*) 1000−888.	(*c*) Rs 48−Rs 29.29
(*d*) 6 m. 72 cm.+3 m. 88 cm.	(*d*) 729×60.
(*e*) 89×6+5.	(*e*) 89×5−5.

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(iii)

Rewrite, filling in the signs :

(*a*) 9 7 4=20.
(*b*) 9 7 4=67.
(*c*) 8 6 2=20.
(*d*) 8 4 5=37.
(*e*) 6 2 3=36.

(iv)

Fill in the blanks :

(*a*) 7 × =63.
(*b*) 7 + =63.
(*c*) −6 =50.
(*d*) 70÷ =10.
(*e*) 7 ×5 = +2.

Compound Division

Example 1.

Divide : 15 Kg. 8 Hg. 5 Dg. 5 gm by 7

$$\begin{array}{rrrrr} & \text{Kg.} & \text{Hg.} & \text{Dg.} & \text{gm.} \\ 7) & 15 & 8 & 5 & 5 \\ \hline & 2 & 2 & 6 & 5 \end{array} \qquad \begin{array}{r} \text{Same as} \\ 7)15{,}855 \\ \hline 2{,}265 \end{array}$$

Ans. 2 Kg. 2 Hg. 6 Dg. 5 gm.

Example 2.

$$\begin{array}{rrrr} & \text{Km.} & \text{m.} & \text{cm.} \\ 9) & 16 & 225 & 38 \\ \hline & 1 & 802 & 82 \end{array} \qquad \begin{array}{r} \text{Same as} \\ 9)16{,}225{,}38 \\ \hline 1{,}802{,}82 \end{array}$$

Ans. 1 Km. 802 m. 82 cm.

Example 3.

Divide : 174 hr 43 min. 36 sec. by 8

$$\begin{array}{lll} \quad 21\ \text{hr} & 50\ \text{min.} & 27\ \text{sec. } \textit{Ans.} \\ \hline 8)174\ \text{hr} & 43\ \text{min.} & 36\ \text{sec.} \\ \quad 16 & 360 & 180 \\ \quad \overline{14} & 8)\overline{403} & 8)\overline{216} \\ \quad 8 & \quad 40 & \quad \overline{56}\ \text{sec.} \\ (a)\ \overline{6\ \text{hr}}\ \text{over} & (b)\ \overline{3\ \text{min.}} & \overline{\text{over}} \end{array}$$

(*a*) 6 × 60 and write the answer under min.

(*b*) 3 × 60 and write the answer under sec.

Exercises 18

1. 9 Kg. 7 Hg. 6 Dg. 8 gm. ÷ 2; ÷ 4; ÷ 8
2. 24 Kg. 4 Hg. 6 Dg. 5 gm. ÷ 3; ÷ 5; ÷ 7
3. 15 Kg. 5 Hg. 3 Dg. 2 gm. ÷ 7; ÷ 9; ÷ 11
4. 5 hr 52 min 48 sec. ÷ 2; ÷ 4; ÷ 3
5. 23 hr. 50 min 24 sec. ÷ 6; ÷ 8; ÷ 12
6. 214 hr. 38 min 15 sec. ÷ 5; ÷ 7; ÷ 11
7. 54 m. 14 cm. 4 mm. ÷ 8; ÷ 9; ÷ 16
8. 138 Kg. 2 Hg. 4 Dg. 8 gm. ÷ 8; ÷ 7; ÷ 12

Races

(i)

(*Write answers only*)

(*a*) Rs. 63·20 ÷ 8.

(*b*) 12 m. 74 cm. ÷ 7

(*c*) $3\frac{1}{2}+2\frac{3}{4}$

(*d*) 765 ÷ 70

(ii)

(*Write answers only*)

(*a*) 10 hr 3 min. ÷ 9.

(*b*) 10 cm. — 2 cm. 8 mm.

(*c*) $3\frac{1}{2}-2\frac{3}{4}$

(*d*) 735 × 12

(iii)

(*Write your work when you wish to*)

(*a*) Divide 813 by 3 and multiply the answer by 4.

(*b*) Take 813 from 1000 and multiply the answer by 9.

(*c*) Write in figures : four lakh seventy-five thousand and seven.

(*d*) Multiply Rs 53·29 by 3.

(*e*) Take 5 Kg. 425 gm from 7 Kg. 225 gm.

Problems

1. If six men share equally a prize of Rs 1953.00, what will each man receive ?

2. A prize was shared equally among seven men. Each man received Rs 5776·75. What was the value of the prize ?

3. A man gave a Rs 100 note in payment for 9 chairs and received back Rs 11·80 change. What did each chair cost ?

4. Eight tennis racquets cost Rs 144. Nine fountain pens also cost Rs 144. Which costs more, a racquet or a pen ? How much more ?

5. A doll's house and five dolls cost Rs. 96·75. The house costs Rs 35·50. What does a doll cost ?

6. A photographer charges Rs 1·25 for an ordinary print and Rs 3·45 for an enlargement. A man ordered 6 enlargements and a doz. prints. What was his bill ?

7. A gun is fired at equal intervals of time. If the 13th shot is fired 21 minutes after the 1st, at what intervals is the gun being fired ?

8. If 275 Kg. 495 gm is the total weight of 11 boxes; what is the weight of each box ?

9. If 12 poles each 12 metres 48 cm long are placed end to end, what would be the total length?

10. A boy's stride is 89 cm. If he takes 12 strides what distance has he covered? Give your answer in metres and centimetres.

11. A boy's span is 18 cm. If he measures a table and finds its length to be 16 spans what is the length of the table ? Give your answer in metres and centimetres.

12. A marble weights 12 gm. What is the weight of 256 marbles? Give your answer in Kilograms and grams.

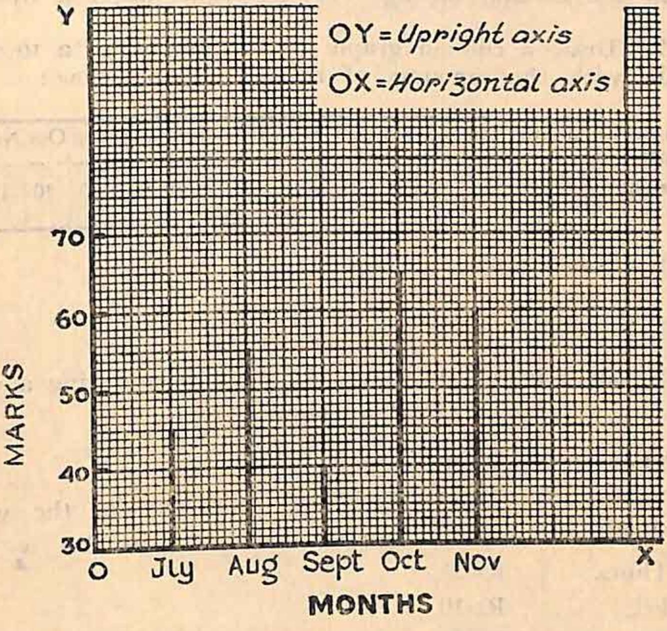
13. A box has 9 tins of Quaker Oats. Each tin weights 454 gm. What is the total weight of the 9 tins? Give your answer in Kilograms and grams.

14. Twenty four exercise books each 6 cm. thick are placed, one on top of the other. What is the height of the pile? Give your answer in metres and centimetres.

The reason for representing certain facts by a graph is to give information rapidly or quickly.

Example

John's marks for the monthly tests from July to November were 45, 55, 40, 65, 60 respectively. Show these marks on a column graph.



Exercises 19

Use squared paper.

1. Draw a column graph to show the average weight of boys of different ages :

Horizontal axis	Age in years	7	8	9	10	11	12	13	14
Upright axis	Weight in Kg.	25	28	31	34	37		44	48

What do you think is the average weight at age 12? Draw the column for age 12. Give the graph a title.

2. Draw a column graph for the rainfall of a town in India with the amounts of rainfall shown below :

Horizontal axis	Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Upright axis	Rainfall in mm.	5	0	0	5	15	100	250	90	55	30	10	

Scale 1 small square=5 mm.

Give the graph a title.

3. In a school tuck-shop the daily sales during a week are given below : Draw a column graph :

Mon.	Rs 40
Tues.	Rs 35
Wed.	Rs 75
Thurs.	Rs 25
Fri.	Rs 10
Sat.	Rs 90

Horizontal axis—day of the week.
Upright axis—sales in Rs.

The children get their pocket money twice a week. Can you say from the graph which days they are ? Give a title for the graph.

4. A boy's height is measured each birthday, and the heights and ages recorded. Show them by a column graph. Give a title for the graph. Choose your own scale.

Age in years	7	8	9	10	11	12	13	14
Height in cm.	120	123		129	133	136	139	143

Using your graph, answer the following questions :

(*a*) What do you think his height was at 9 years?

(*b*) What was probably his height when he was 12½ years?

(*c*) Between the ages of 10 and 13½ he grew how many centimetres ?

Bills

Make out a bill for 5½ metres serge, 3¼ Kg. wool, 8 dozen buttons. Prices given below.

	Rs	P
5 m serge at Rs 14·50 a metre	72	50
½ m serge at Rs 14·50 a metre	7	25
3 Kg. wool at Rs 38 a Kg.	114	00
¼ Kg. wool at Rs 38 a Kg.	9	50
8 doz. buttons at 80 P a doz.	6	40
Total	209	65

Rs. P
Ans. 209 65

Exercises 20

Catalogue Prices

Serge	Rs 14·50 a metre	Oil	Rs 1·10 a litre
Ribbon	Rs 2·40 a metre	Sugar	Rs 1·20 a Kg.
Button	Rs 0·80 a doz	Eggs	Rs 3·20 a score
Sheeting	Rs 2·60 a metre	Butter	Rs 7·20 a Kg.
Wool	Rs 38 a Kg.	Toffee	Rs 4·80 a Kg.

Make out bills for :

1. (*a*) $2\frac{1}{2}$ metres serge, 5 metres ribbon, $1\frac{1}{2}$ Kg. wool.
   (*b*) 42 buttons, 30 eggs, $1\frac{1}{2}$ Kg. butter, $\frac{1}{2}$ Kg. Toffee.
   (*c*) 6 metres sheeting, $3\frac{1}{2}$ metres ribbon, $2\frac{1}{2}$ litres oil.
   (*d*) 4 doz buttons, 5 Kg. sugar, 3 score eggs.

2. (*a*) 8 litres oil, $7\frac{1}{2}$ metres serge, $8\frac{1}{2}$ metres ribbon.
   (*b*) $3\frac{3}{4}$ metres sheeting, $\frac{3}{4}$ score eggs, $2\frac{3}{4}$ Kg. toffee.
   (*c*) 5 Kg. sugar, 250 gm butter, 54 buttons.
   (*d*) $1\frac{1}{4}$ Kg. wool, $2\frac{1}{4}$ Kg. butter, $4\frac{3}{4}$ litres oil.

Individual Work I

(*Work by yourselves and check your answers with those given at the end of the book*)

A

1. How many times can 83 be subtracted from 7005?

2. A fountain pen costs Rs. 8·75 and a propelling pencil Rs. 4·25. What will have to be paid for 4 pens and 6 pencils?

3. A train which was running 15 min. late arrived at a station at 9–50 a.m. At what time would it have arrived if it were running 7 min. early?

B

1. Can 792 marbles be divided equally among 24 boys? What will each boy receive?

2. Divide Rs 297·84 into 8 equal shares ?

3. A cart weighs 105 Kg. What will it weigh with a load of 7 bags of sand each weighing 22 Kg. 275 gm?

4. 124 metres of fencing just do to enclose a rectangular playground. If the playground is 27 metres broad, how long is it?

C

1. $56 \times 7136 + 245$.

2. Which will weigh more : 7 tins of jam each weighing 375 gm or 5 bottles each weighing 523 gm ? How much more ?

3. (*a*) Divide 6048 by 72, using factors.
   (*b*) Multiply 84 by 28, using factors.

4. (*a*) Multiply 14 Kg. 7 Hg. 5 Dg. 8 gm. by 8.
   (*b*) Divide 17 Kg. 6 Hg. 6 Dg. 7 gm by 9.

D

1. (*a*) Divide 786 by 35, using factors.
   (*b*) Multiply 317 by 24, using factors.

2. Penknives are being sold at Rs 2·43 each. How much more will have to be paid for 23 penknives than for 18 ?

3. How much must a dealer pay for 7 cycles at Rs 253·65 each ?

E

1. Find the value of $20000 - 65 \times 273$.

2. Divide 37 m. 45 cm. by 5.

3. If you have saved Rs 14·50, how much more must you save to be able to buy a camera for Rs 12.00 and six rolls of films at 75 P each?

4. A passenger travelling by train has $65\frac{1}{2}$ Kg. of luggage. He is allowed 40 Kg. free of charge and has to pay for the rest of the luggage at the rate of Rs 2 per Kg. Find how much he has to pay.

F

1. Divide (*a*) 6357 by 79 (*b*) 8937 by 28, using factors.

2. A man borrows Rs 100 and pays back Rs 8·25 a month. How much will he still owe after a year ?

3. x stands for a missing number. Find x.

(*a*) $7 + x = 3 \times 15$ (*c*) $85 \times x = 1955$
(*b*) $3 \times x = 15 \times 2$ (*d*) $x \div 17 = 459$

G

1. There are seven boys in a tug-of-war team. The weight of six of them are 44 Kg. 25 gm. 49 Kg. 350 gm, 48 Kg. 455 gm, 40 Kg. 612 gm; 33 Kg. 127 gm, 49 Kg. 325 gm. The total weight of the team is 309 Kg. 358 gm. What is the weight of the seventh boy ?

2. 16 hr 32 min. 9 sec. × 9.

3. Prize books are bought at Rs 7·65 each. How much more must be paid for 17 of them than for 13 ?

4. If a piece of cloth is 13 metres 75 cm. long is divided into 11 equal lengths, how long will each piece be ?

Tenths

Fig. 1 shows part of a ruler marked in tenths of a centimetre.

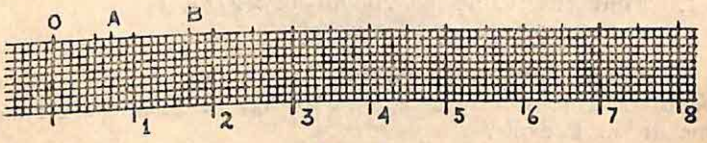


Fig. 1

In the diagram $OA = 7$ mm. or $\frac{7}{10}$ cm.
$OB = 1$ cm. 7 mm. or $1\frac{7}{10}$ cm.

Exercises 21

1. Using your ruler draw straight lines of length $2\frac{3}{10}$ cm., $3\frac{5}{10}$ cm. $4\frac{6}{10}$ cm., $8\frac{7}{10}$ cm., $4\frac{2}{10}$ cm., $6\frac{9}{10}$ cm., $7\frac{8}{10}$ cm., $8\frac{1}{10}$ cm.

2. Draw a line *AB* $5\frac{4}{10}$ cm. long. It is then made $2\frac{3}{10}$ cm. longer. How long $\frac{10}{6}$ is it now?

3. Draw a line *AB* $5\frac{6}{10}$ cm. long. Cut off $BC=2\frac{2}{10}$. How long is *AC* ?

4. $\frac{10}{10}=1$ (=ten tenths)=1.
$\frac{20}{10}=2$(=20 tenths)=2.
What will $\frac{30}{10}=$? $\frac{40}{10}=$? $\frac{50}{10}=$? $\frac{70}{10}=$?
$\frac{100}{10}=$? $\frac{120}{10}=$? $\frac{150}{10}=$? $\frac{200}{10}=$?

5. 12 tenths $=\frac{12}{10}$, that is 1 whole and 2 tenths and is written as $1\frac{2}{10}$.

24 tenths$=\frac{24}{10}$, that is 2 wholes and 4 tenths and is written $2\frac{4}{10}$.

Write the following as whole numbers and tenths : $\frac{14}{10}$; $\frac{22}{10}$; $\frac{36}{10}$; $\frac{45}{10}$; $\frac{59}{10}$; $\frac{100}{10}$; $\frac{109}{10}$; $\frac{127}{10}$

6. Write the following in tenths ?
$1\frac{3}{15}$, $2\frac{4}{10}$, $2\frac{1}{2}$, $4\frac{1}{2}$, $7\frac{1}{2}$, $6\frac{9}{10}$, $8\frac{7}{10}$, $9\frac{1}{10}$

Example 1.

Add:

$$\begin{array}{r} 3\frac{2}{10} \\ +4\frac{3}{10} \\ +6\frac{8}{10} \\ \hline \textit{Ans. } 14\frac{3}{10} \\ \hline \end{array}$$

$\frac{13}{10}$
$=1\frac{3}{10}$
carry 1.

Example 2.

Substract :

$$\begin{array}{r} 4\frac{3}{10} \\ -2\frac{6}{10} \\ \hline \textit{Ans } 1\frac{7}{10} \\ \hline \end{array}$$

We cannot take $\frac{6}{10}$ from $\frac{3}{10}$; so add 1 or $\frac{10}{10}$. We now have $\frac{13}{10}$. $\frac{6}{10}$ from $\frac{13}{10}$ leaves $\frac{7}{10}$.

1. $\begin{array}{r} 3\frac{2}{10} \\ +4\frac{4}{10} \\ +6\frac{5}{10} \\ \hline \\ \hline \end{array}$ 2. $\begin{array}{r} 2\frac{1}{2} \\ +3\frac{9}{10} \\ +5\frac{7}{10} \\ \hline \\ \hline \end{array}$ 3. $\begin{array}{r} 3\frac{2}{10} \\ +4\frac{3}{10} \\ +2\frac{5}{10} \\ \hline \\ \hline \end{array}$ 4. $\begin{array}{r} 5\frac{3}{10} \\ +3\frac{9}{10} \\ +4 \\ \hline \\ \hline \end{array}$

5. $3\frac{9}{10}+4+\frac{4}{10}$ **6.** $6\frac{1}{2}+3\frac{1}{2}+2\frac{9}{10}$

7. $4\frac{3}{10}-2\frac{1}{10}$

8. $5\frac{1}{10}-2\frac{8}{10}$

9. $6\frac{8}{10}-2$

10. $6 \ -2\frac{3}{10}$

11. $6\frac{1}{2} \ -3\frac{1}{10}$

12. $6\frac{1}{10}-3\frac{1}{2}$

13. $7\frac{1}{10}+3\frac{3}{10}-5\frac{4}{10}$

14. $7\frac{1}{10}+3\frac{3}{10}-5\frac{8}{10}$

15. $6\frac{1}{2}+4\frac{1}{2}-2\frac{8}{10}$

Example 3. 3 tenths × 6 = 18 tenths

$$\begin{aligned} \tfrac{3}{10}\times 6 &= \tfrac{18}{10} \\ &= 1\tfrac{8}{10} \end{aligned}$$

16. (*a*) $\frac{5}{10}\times 7=\frac{35}{10}=3\frac{5}{10}$
(*b*) $\frac{5}{10}\times 6=$; (*c*) $\frac{8}{10}\times 7=$; (*d*) $\frac{6}{10}\times 3=$;
(*e*) $\frac{3}{10}\times 8=$; (*f*) $\frac{9}{10}\times 8=$; (*g*) $\frac{9}{10}\times 9=$; (*h*) $\frac{4}{10}\times 10$;
(*i*) $\frac{5}{10}\times 10=$; (*j*) $\frac{8}{10}\times 12=$; (*k*) $\frac{4}{10}\times 12=$; (*l*) $\frac{8}{10}\times 16=$.

Example 4.

$$\begin{array}{r} 4\frac{3}{10} \\ \times 7 \\ \hline 30\frac{1}{10} \\ \hline \end{array} \qquad \frac{21}{10}=2\frac{1}{10}$$

Put down $\frac{1}{10}$ and carry 2.

17. (*a*) $3\frac{4}{10}\times 7$
(*b*) $5\frac{6}{10}\times 5$
(*c*) $6\frac{8}{10}\times 12$
(*d*) $5\frac{4}{10}\times 16$
(*e*) $2\frac{3}{10}\times 6$
(*f*) $2\frac{9}{10}\times 8$
(*g*) $6\frac{8}{10}\times 12$
(*h*) $5\frac{7}{10}\times 16$
(*i*) $5\frac{5}{10}\times 6$
(*j*) $4\frac{9}{10}\times 10$
(*k*) $6\frac{9}{10}\times 12$
(*l*) $5\frac{9}{10}\times 16$

Problems

1. Two towns are 5 Km. apart. An inn on the road between them is $1\frac{3}{10}$ Km. from one town. How far is it from the other town ?

2. A traveller is $4\frac{6}{10}$ Km. from a town A and $2\frac{5}{10}$ Km. from a town B. How far apart are A and B ?

3. A man has to cycle 6 Km. to town. After he had cycled $2\frac{8}{10}$ Km. his cycle broke down, and he had to walk the remaining distance. What distance had he to walk ?

4. On a road five water taps are placed $3\frac{7}{10}$ Km. apart. How far is the first water tap from the fifth?

5. If 12 books each $3\frac{7}{10}$ cm. thick are placed one on top of the other, how high will the books be?

6. What length is a string, if I can cut it into 7 equal pieces of $7\frac{8}{10}$ cm. length?

7. If 9 pieces, each $8\frac{4}{10}$ cm. long, are cut from a string 78 cm. long, what length will remain?

8. There are 25 litres of water in a tub. I remove 8 jugs of water from it. If a jug holds $2\frac{7}{10}$ litres, how much water is left in the tub?

9. A man has 27 Kg. of wheat in a box. If he uses $1\frac{8}{10}$ Kg. every day, how much has he left after nine days?

10. Cook uses $2\frac{7}{10}$ Kg. of wood every day. How much will be use in two weeks ?

11. Father buys 100 grams of tobacco. If he uses $9\frac{9}{10}$ gms every day, how much has he left after 8 days?

Decimals

10 10-P pieces = Re 1
1 10-P piece = Re $\frac{1}{10}$
Read Re 0.10 = one 10-P pieces = Re $\frac{1}{10}$
Re 0.20 = two 10-P pieces = Re $\frac{2}{10}$
Re 0.30 = three 10-P pieces = Re $\frac{3}{10}$
etc.

Rs 3·10 = Rs 3 $\frac{1}{10}$
Rs 4·30 = Rs 4 $\frac{3}{10}$
etc.

Exercises 22

Fill in the blanks :

[Can be written as

Rs 3·50 = Rs $3\frac{5}{10}$

Rs 7·20

Rs 6·40 =

Rs 7·60 =

Rs 0·70 =

Rs 6·90 =

Rs 5·10 =

Rs 4·80 =

Rs 5·00 =

Rs 4·30 =

Can be written as

Rs $3\frac{4}{10}$ = Rs 3·40]

Rs $5\frac{1}{10}$ =

Rs $8\frac{2}{10}$ =

Rs $6\frac{7}{10}$ =

Rs $2\frac{5}{10}$ =

Rs $7\frac{4}{10}$ =

Rs $8\frac{3}{10}$ =

Rs $7\frac{8}{10}$ =

Rs $4\frac{9}{10}$ =

Rs $3\frac{6}{10}$ =

The Tenths Column

Look at the starred figures in the numbers given below :

Thus we write $3\frac{4}{10}$ cm. as 3·4* cm.
$4\frac{7}{10}$ Km. as 4·7* Km.
$6\frac{8}{10}$ Kg. as 6·8* Kg.
$2\frac{3}{10}$ litres as 2·3* litres or 2·3 l.

We name this point just "the decimal point", not "the paisa point."

The decimal point tells us that the figures to the right of it are so many tenths of whatever unit we are using.

If we are measuring in cm., then 3·7 cm. will mean $3\frac{7}{10}$ cm.

If we are timing a race 11·4 sec. means $11\frac{4}{10}$ sec.

The Hundredths Column

100 P. Rupee.
So 1 P = $\frac{1}{100}$ Rupee or Re $\frac{1}{100}$ (one hundredth).
100 cm = 1 metre.
1 cm = $\frac{1}{100}$ metre.
100 centilitre = 1 litre.
1 centilitre = $\frac{1}{100}$ litre.

In Rs 8·69, 5·45, 3.21 the 9, 5, 1 stand for so many naye paise or Re $\frac{9}{100}$, Rs $\frac{5}{100}$, Re $\frac{1}{100}$.

Rs 7·85 would mean Rupees 7 plus 8 tenths of a rupee plus 5 hundredths of a Rupee.

8·79 7etres would mean 8 metres+$\frac{7}{10}$ metre+$\frac{9}{100}$ metre.
4·75 litres would mean 4 litres+$\frac{7}{10}$ litre +$\frac{5}{100}$ litre.

The Tenths Column

Look at the starred figures in the numbers given below :

Rs

7·$\overset{*}{2}$5

8·$\overset{*}{3}$7

9·$\overset{*}{8}$4

8·$\overset{*}{5}$6

2·$\overset{*}{7}$3

All the starred figures stand for "tenths of a Rupee". All of them are in the first column to the right of the P point. We shall call this column "the tenths column." In the same way as we use the tenths column to write tenths of a Rupee, we also use it to write tenths of other quantities.

Thus we write $3\frac{4}{10}$ inches as 3·4 in.

$4\frac{7}{10}$ miles as 4·7 miles.

We do not now name the point "the paisa point" but just "the decimal point".

The decimal point tells us that the figures to the right of it are so many *tenths* of whatever unit we are using.

Thus if we are measuring in pins.

3·7 pints will mean $3\frac{7}{10}$ pints.

If we are timing a race,

11·4 minutes will mean $11\frac{4}{10}$ minutes.

Exercises 23

$3\frac{5}{10}$ cm. can be written as 3·4 cm.
$4\frac{7}{10}$ Km. " " "
$2\frac{8}{10}$ litres " " "
$5\frac{6}{10}$ minutes " " "
" " " 2·4 Km.
" " " 3·9 m.
" " " 8·5 l.
" " " 4·7 hr.
" " " 9·1 Kg.
" " " 8·6 cm.

Example 1. Add 2·7 cm. to 3·1 cm.

$$\begin{array}{l} 2\cdot7\text{ cm.}\\ 3\cdot1\text{ cm.}\\ \hline 5\cdot8\text{ cm.}\\ \hline \end{array}$$

Ans. 5·8 cm.

Example 2. Add 2·5 litres+8·7 litres+6·9 litres.

2·5 litres
8·7 litres
6·9 litres

18·1 litres *Ans.* 18·1 litres.

Exercises 24

1. 3·7 Km.+6·2 Km.+8·9 Km.
2. 2·3 m.+4·6 m.+7·1 m.
3. 4·5 sec.+8·9 sec.+9·8 sec.
4. 5·7 m.—3·2 m.
5. 6·1 m.—4·9 m.
6. 8·5 m.+4·6 m.+9·2 m.
7. 7·2 m.+9·3 m.—4·5 m.
8. 6·5 l.+8·2 l.—2·3 l.
9. 2·5 Kg.+9·4 Kg.+8·7 Kg.
10. 6·9 Kg.+8·5 Kg.—7·9 Kg.
11. 4·2+3·7+8·9
12. 8·6+9·5+11·7
13. 7·9+9·7+6·8
14. 8·2+7·5+9·3
15. 7·4—3·9
16. 8·1—4·8
17. 2·3+8·9—5·6
18. 6·8+7·2—9·8
19. 7·2—4·3+8·7
20. 11·2+13·9—21·5

Hundredths

Study this table :

	Thousands	Hundreds	Tens	Units	Tenths	Hundredths	
1)				3	2		$= 3\frac{2}{10} = 3{\cdot}2$
2)			4	5	3		$= 45\frac{3}{10} = 45{\cdot}3$
3)			4	5	3	6	$= 45\frac{36}{100} = 45{\cdot}36$
4)		2	3	4	7	9	= 234·79
5)	8	6	5	9	1	8	= 8659·18
6)		3	0	7	2	4	= 307·24

The thick line after 'units' stands for the decimal point.

Exercises 25

Make a table as above and show in it the following :

1. 2·35
2. 3·67
3. 3·05
4. 4·50
5. 21·21
6. 20·35
7. 20·04
8. 33·67
9. 251·35
10. 203·79
11. 6 tenths
12. 7 tenths
13. 9 hundredths
14. $3+\frac{7}{10}+\frac{5}{100}$
15. 21+
16. 423·81
17. 500·04
18. 7010·05
19. $235+\frac{6}{10}+\frac{7}{100}$
20. $405+\frac{17}{100}$
21. $256+\frac{25}{100}$
22. $275+\frac{18}{100}$
23. 85 tenths
24. 84 hundredths
25. 29 hundredths

Write in decimals :

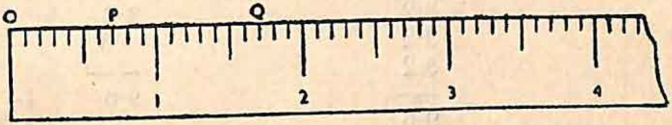
26. $\frac{7}{10}+\frac{5}{100}$
27. $\frac{8}{10}+\frac{6}{100}$
28. $3+\frac{3}{10}+\frac{3}{100}$
29. $15+\frac{2}{10}+\frac{5}{100}$
30. $6+\frac{3}{10}+\frac{9}{100}$
31. $15+\frac{6}{100}$

Write in full as in nos. 26—31

32. 7·9; 0·6; 0·9
33. 2·03; 0·01; 0·09
34. 2·05; 3·15; 30·01
35. 401·17; 806·07; 70·09

Tenths of an Inch

Exercises 26



(The ruler does not show the actual length in inches)

1. We can write the length *OP* as 0·7 in.

How can we write the length *OQ* ?
If *OR*=3·2 in., mark the point *R*.

2. How many tenths of an inch are there in half an inch? Write ½ in. as a decimal.

3. Use your ruler to draw straight lines of length :
1·4 in.; 2·5 in.; 3·3 in.; 1·8 in.; 2·9 in.;
4·1 in.; 3·7 in.; 2·4 in.; 2·2 in.; 1·6 in.;

4. Draw a line *AB* 2·6 in. long, then produce *AB* towards *B* and mark off *BC* equal to 1·3 in. How long would you expect *AC* to be? Test by measuring with your ruler.

5. A line 3·7 in. is drawn and then a length 2·4 in. is added to it on one side and 1·8 in. is added on the other side. How long is the line now ?

Do this sum, first drawing the lines with your ruler, and then without drawing.

6. *OM*=2·6 in., *OS*=3·1 in. Mark the points *M* and *S* in line with *O*. Can you tell the length of *MS* without measuring? Check your answer by measuring.

7. Use your ruler to draw a straight line *MN*=3·5 in. From it cut off a part equal to 0·8 in. Can you tell the length of the other part? Check your answer by measuring.

Decimals Multiplication by a Whole Number

Example 1. Multiply 3·2×5.

1st way : Add

$$\begin{array}{r} 3{\cdot}2 \\ 3{\cdot}2 \\ 3{\cdot}2 \\ \hline 9{\cdot}6 \\ \hline \end{array}$$

2nd way : Multiply

$$\begin{array}{r} 3{\cdot}2 \\ \times 3 \\ \hline 9{\cdot}6 \\ \hline \end{array}$$

Example 2.

$$\begin{array}{r} 3{\cdot}6 \\ 7 \\ \hline 25{\cdot}2 \textit{ Ans.} \\ \hline \end{array}$$

Example 3.

$$\begin{array}{r} 4{\cdot}56 \\ 4 \\ \hline 18{\cdot}24 \\ \hline \end{array}$$

Exercises 27

1. 4·7 cm. ×8
2. 3·8 cm. ×9
3. 6·9 Kg. ×8
4. 12·6 Kg. ×7
5. 8·19 m. ×6
6. 8·27 m. ×5
7. 7·49 l. ×4
8. 8·97 l. ×8
9. 7·6 min. ×7
10. 9·12 min. ×9
11. 14·5 cm. ×4.
12. 82·4×5
13. 79·8×7
14. 83·5×10
15. 92·75×10
16. 64·6×11
17. 63·25×11
18. 42·37×12
19. 81·12×16
20. 89·89×16

Decimals Multiplication

by a whole Number

Example 1.

Here are four lines end-to-end each 1·2 in. long.

(Actual length is not shown)

How long is the whole line ?

1st way : Add

$$\begin{array}{r} \text{in.} \\ 1{\cdot}2 \\ +1{\cdot}2 \\ +1{\cdot}2 \\ +1{\cdot}2 \\ \hline 4{\cdot}8 \text{ in. } \textit{Ans.} \\ \hline \end{array}$$

2nd way : Multiply

$$\begin{array}{l} \text{in.} \\ 1{\cdot}2 \\ \times 4 \\ \hline 4{\cdot}8 \text{ in. } \textit{Ans.} \\ \hline \end{array}$$

Example 2.

$$\begin{array}{r} 3{\cdot}7 \\ \times 6 \\ \hline 22{\cdot}2 \; \textit{Ans.} \\ \hline \end{array}$$

Example 3

$$\begin{array}{r} 54{\cdot}8 \\ \times 7 \\ \hline 383{\cdot}6 \; \textit{Ans.} \\ \hline \end{array}$$

Exercises 28

1. 4·7 in. × 8
2. 3·2 hr × 5
3. 6·8 lb. × 6
4. 7·2 gall. × 9
5. 0·5 ft. × 7
6. 0·5 min. ×16
7. 7·5 lb. × 6
8. 8·8 gall. ×12
9. 25·6 yd. × 4
10. 32·4 sec. ×11
11. 43·6 lb. ×10
12. 34·9 gall. × 6

13. 77·7 × 9
14. 63·4 × 16
15. 37·5 × 8
16. 63·4 × 9
17. 36·3 × 16
18. 34·7 × 11
19. 83·9 × 12
20. 44·7 × 12
21. 53·6 × 10
22. 73·5 × 9
23. 81·2 × 11
24. 35·7 × 16

Decimals Division by a whole number

Example 1. 426·4÷4

4)426·4

106·6

Example 2. 37·45÷7

7)37·45

5·35

Exercises 29

1. 14·8 cm. ÷4
2. 25·2 Kg. ÷9
3. 47·2 gm. ÷8
4. 39·6 l. ÷6
5. 22·35 m. ÷5
6. 12·18 Kg. ÷7
7. 92·25 m. ÷9
8. 73·04 m. ÷8
9. 82·08 gm ÷6
10. 92·05 gm ÷7
11. 13·6 ÷ 4
12. 27·23÷ 7
13. 80·28÷12
14. 39·72÷12
15. 670·4 ÷16
16. 812·48÷16
17. 427·57÷11
18. 810·92÷11
19. 231·84÷12
20. 144·64÷16

Oral

1. By how much is $\frac{5}{6}$ greater than $\frac{1}{6}$?
2. By how much is $\frac{5}{6}$ greater than $\frac{2}{6}$?
3. Add $\frac{1}{6}$ to $\frac{5}{6}$.
4. By how much is $\frac{4}{6}$ less than 1 ?
5. Substract $\frac{5}{6}$ from 1.
6. $\frac{1}{6}+\frac{4}{6}-\frac{2}{6}$.

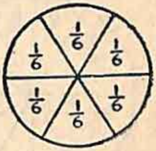


Fig. 2 (*a*)

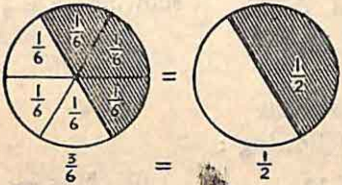


Fig. 2 (*b*)

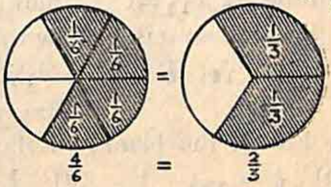


Fig. 2 (*c*)

A simpler way of writing
$\frac{3}{6}$ is $\frac{1}{2}$

A simpler way of writing
$\frac{4}{6}$ is $\frac{2}{3}$

7. A simpler way of writing $\frac{2}{6}$ is. . . .
Draw a diagram.

Add : $\frac{1}{2}$ and $\frac{1}{3}$

$$\begin{array}{ccr} \frac{1}{2} & = & \frac{3}{6} \\ +\frac{1}{3} & = & +\frac{2}{6} \\ \hline & & \frac{5}{6}\ \textit{Ans.} \\ \hline \end{array}$$

In your exercise books work :

8. $\frac{1}{2}+\frac{1}{6}$
9. $\frac{1}{3}-\frac{1}{6}$
10. $\frac{5}{6}-\frac{1}{6}$
11. $\frac{5}{6}-\frac{1}{3}$
12. $\frac{5}{6}-\frac{1}{2}$
13. $\frac{5}{6}-\frac{1}{2}+\frac{1}{3}$

Twelfths

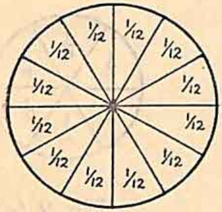


FIG. 3(*a*)

showing $12 \times \frac{1}{12} = 1$

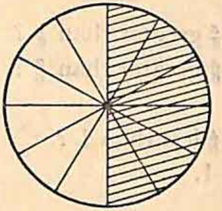


FIG. 3(*b*)

showing $\frac{6}{12} = \frac{1}{2}$

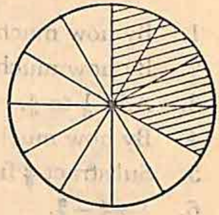


FIG. 3(*c*)

showing $\frac{4}{12} = \frac{1}{3}$

Draw diagrams to show that

$\frac{1}{4} = \frac{3}{12}$; $\frac{3}{4} = \frac{9}{12}$; $\frac{1}{6} = \frac{2}{12}$; $\frac{5}{6} = \frac{10}{12}$

Exercises 30

1. Fill in the blanks in the following :

(*a*) $\frac{1}{6} = \frac{}{12}$;
(*b*) $\frac{3}{6} = \frac{}{12}$;
(*c*) $\frac{5}{6} = \frac{}{12}$;
(*d*) $\frac{1}{4} = \frac{}{12}$
(*e*) $\frac{8}{12} = \frac{}{3}$
(*f*) $\frac{9}{12} = \frac{}{4}$
(*g*) $\frac{2}{3} = \frac{}{12}$
(*h*) $\frac{10}{12} = \frac{}{6}$

Example 1.

Add : $\frac{5}{6} + \frac{1}{12}$

$\frac{5}{6} = \frac{10}{12}$

$\frac{1}{12} = \frac{1}{12}$

$\frac{11}{12}$ *Ans.*

Example 2.

$\frac{7}{12} - \frac{1}{6}$

$\frac{7}{12} = \frac{7}{12}$

$\frac{1}{6} = \frac{2}{12}$

$\frac{5}{12}$ *Ans.*

2. Add together :

$\frac{2}{3} + \frac{1}{6}$; $\frac{1}{3} + \frac{1}{6}$; $\frac{3}{12} + \frac{5}{12}$; $\frac{1}{3} + \frac{1}{4} + \frac{1}{12}$
$\frac{1}{3} + \frac{1}{4} + \frac{1}{6} + \frac{1}{12}$; $\frac{3}{4} + \frac{1}{12}$; $\frac{5}{6} + \frac{1}{12} + \frac{5}{12}$

3. $\frac{5}{12} - \frac{1}{12}$; $\frac{8}{12} - \frac{3}{12}$; $\frac{11}{12} - \frac{2}{6}$; $\frac{1}{3} - \frac{1}{4}$; $\frac{1}{2} - \frac{5}{12}$; $\frac{3}{4} - \frac{7}{12}$

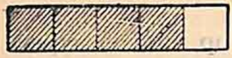
4. $2\frac{5}{6}$ can be written as $\frac{17}{6}$.

Write the following in the second of these ways :

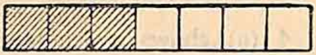
$1\frac{1}{4}$, $3\frac{1}{4}$, $1\frac{5}{6}$, $2\frac{5}{8}$, $2\frac{1}{2}$, $3\frac{1}{12}$, $2\frac{5}{6}$, $2\frac{5}{12}$,
$4\frac{1}{2}$, $2\frac{7}{12}$, $1\frac{1}{6}$, $5\frac{1}{8}$, $6\frac{2}{3}$, $7\frac{1}{12}$, $7\frac{7}{8}$, $5\frac{5}{6}$.

5. Write these in the first way :

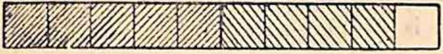
$\frac{27}{4}$, $\frac{27}{6}$, $\frac{31}{12}$, $\frac{43}{12}$, $\frac{43}{8}$, $\frac{41}{2}$, $\frac{19}{8}$, $\frac{19}{12}$,
$\frac{37}{6}$, $\frac{63}{8}$, $\frac{19}{3}$, $\frac{29}{3}$, $\frac{29}{8}$, $\frac{53}{12}$, $\frac{73}{6}$, $\frac{43}{4}$,



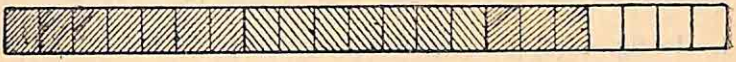
4/5
Fig. 4 (*a*)



3/7
Fig. 4 (*b*)



9/5 or $1\frac{4}{5}$
Fig. 4(*c*)



17/7 or $2\frac{3}{7}$
Fig. 4 (*d*)

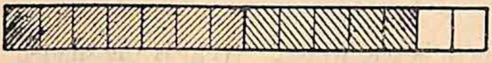


Fig 4 (*e*)

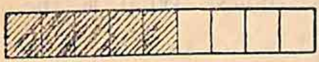


Fig 4 (*f*)

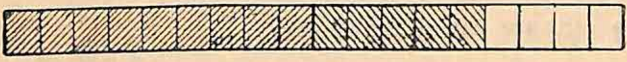


Fig 4 (*g*)

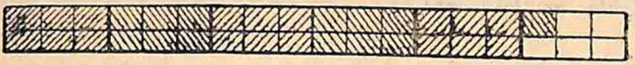


Fig. 4 (*h*)

Oral

1. Fig. 4 (*a*) shows a whole divided up into 5 equal parts. The shaded portion contains 4 of these parts. So the shaded portion is $\frac{4}{5}$ (*four-fifths*) of the whole or, shortly, $\frac{4}{5}$.

2. Fig. 4 (*b*) shows a whole divided up into 7 equal parts. The shaded portion is $\frac{3}{7}$ (*three-sevenths*).

3. In fig. 4 (*c*) there are two wholes. Each is divided up into 5 equal parts. The shaded portion contains 1 whole $+\frac{4}{5}$ or $\frac{9}{5}$ in all. We can write this as either $1\frac{4}{5}$ or $\frac{9}{5}$.

4. In fig. 4 (*d*) there are three wholes. Each is divided up into 7 equal parts. The shaded portion is equal to $2\frac{3}{7}$ or $\frac{17}{7}$.

5. In fig. 4 (*e*) there are two wholes. What is the shaded portion equal to ?

6. In fig. (4) (*f*) there is one whole. What is the shaded portion equal to ?

7. In fig. 4 (*g*) there are two wholes. What is the shaded portion equal to ?

8. In fig. 4 (*h*) there are six wholes. What is the shaded portion equal to ?

$\frac{4}{7}$, $\frac{3}{8}$, $\frac{5}{3}$, $\frac{9}{4}$ etc. are called **fractions.**

The lower number is called the **denominator** or naming part of the fraction. It tells us whether the fraction is *sevenths* or *eighths or thirds* etc.

The upper number is the **numerator** or numbering part. It tells us how many *sevenths* or *eighths* or *thirds* etc. there are.

Exercises 31

1. Draw diagrams like those of fig. 4, to show the following fractions :

$\frac{4}{7}$, $2\frac{4}{7}$, $\frac{3}{5}$, $2\frac{3}{5}$, $3\frac{1}{5}$, $\frac{5}{6}$, $2\frac{5}{6}$, $\frac{4}{5}$, $2\frac{2}{9}$.

2. Which of these fractions is greater than 1 (or a whole) ?

$\frac{3}{5}$, $\frac{7}{5}$, $\frac{8}{12}$, $\frac{12}{8}$, $\frac{9}{4}$, $\frac{13}{14}$, $\frac{13}{10}$, $\frac{7}{9}$, $\frac{9}{7}$, $\frac{2}{11}$, $\frac{13}{12}$, , $\frac{11}{3}$, $\frac{4}{9}$, $\frac{5}{7}$, $\frac{8}{5}$, $\frac{98}{24}$,
$\frac{30}{24}$, $\frac{70}{80}$.

3. Write 1 (or a whole) as 'sevenths'.. $\frac{7}{7}$ (sevent-sevenths)

Write 1 as 'eighths'..

Write 1 as 'twelfths'..

Write 1 (or a whole) as 'thirteenths'..

$\frac{4}{7}$ is less than 1 (or a whole)

$\frac{4}{7}$ is called a **proper fraction.**

$\frac{7}{7}$ is the same as 1 (or a whole).

$\frac{9}{7}$ is greater than 1 (or greater than a whole).

$\frac{9}{7}$ is called an **improper fraction.**

Every improper fraction can be written as a combination of a whole number and a proper fraction.

Thus, the improper fraction can be written as $1\frac{2}{7}$

$\frac{12}{5}$ can be written as $2\frac{2}{5}$.

$\frac{13}{6}$ can be written as $2\frac{1}{6}$.

$1\frac{2}{7}$, $2\frac{2}{5}$, $2\frac{2}{6}$, etc. are called **mixed numbers.**

4. How should these improper fractions be written as mixed numbers ?

$\frac{9}{5}$, $\frac{10}{7}$, $\frac{12}{9}$, $\frac{12}{11}$, $\frac{13}{10}$, $\frac{15}{13}$, $\frac{19}{16}$, $\frac{25}{12}$, $\frac{38}{12}$, $\frac{50}{16}$, $\frac{26}{9}$, $\frac{28}{9}$,
$\frac{60}{11}$, $\frac{77}{16}$, $\frac{90}{16}$, $\frac{8}{7}$, $\frac{45}{6}$, $\frac{50}{8}$, $\frac{50}{7}$, $\frac{65}{16}$, $\frac{65}{7}$, $\frac{100}{12}$, $\frac{69}{8}$, $\frac{125}{11}$.

5. How should these mixed numbers be written as improper fractions ?

$3\frac{1}{5}$, $7\frac{2}{5}$, $6\frac{2}{3}$, $3\frac{4}{7}$, $2\frac{5}{7}$, $11\frac{3}{7}$, $4\frac{2}{11}$, $3\frac{5}{12}$, $6\frac{2}{11}$,
$4\frac{5}{9}$, $11\frac{5}{9}$, $3\frac{3}{10}$, $4\frac{4}{10}$, $1\frac{1}{50}$, $1\frac{1}{63}$, $1\frac{2}{63}$, $1\frac{1}{54}$,
$1\frac{2}{54}$, $2\frac{1}{100}$, $3\frac{1}{100}$, $4\frac{10}{12}$, $5\frac{10}{11}$, $6\frac{1}{20}$, $6\frac{7}{10}$.

6. Which is greater ?

$\frac{11}{7}$ or $1\frac{3}{7}$? $\frac{12}{5}$ or $2\frac{3}{5}$? $\frac{13}{6}$ or $1\frac{5}{6}$?
$\frac{28}{7}$ or $3\frac{4}{7}$? $\frac{60}{9}$ or $5\frac{7}{9}$? $\frac{70}{11}$ or $6\frac{5}{11}$?
$\frac{19}{20}$ or $1\frac{1}{20}$? $\frac{45}{7}$ or $6\frac{5}{7}$? $\frac{66}{9}$ or $5\frac{5}{9}$?

will the parts be larger or smaller than when it is divided up into 6 equal parts ?

Which is greater, $\frac{1}{6}$ or $\frac{1}{5}$?

$\frac{1}{7}$ or $\frac{1}{5}$? $\frac{1}{9}$ or $\frac{1}{6}$? $\frac{1}{8}$ or $\frac{1}{9}$?
$\frac{1}{12}$ or $\frac{1}{11}$? $\frac{1}{13}$ or $\frac{1}{11}$? $\frac{1}{7}$ or $\frac{1}{12}$?

8. Which is greater, $\frac{1}{8}$ or $\frac{1}{9}$?

$\frac{5}{8}$ or $\frac{5}{9}$? $\frac{6}{7}$ or $\frac{6}{8}$? $\frac{5}{12}$ or $\frac{5}{11}$?
$\frac{4}{13}$ or $\frac{4}{11}$? $\frac{7}{9}$ or $\frac{7}{12}$?

9. What happens to a fraction if its denominator is increased ? Does the fraction become larger or smaller ?

What happens to a fraction if its numerator is increased ? Does the fraction become larger or smaller ?

10. How much will you have to add to or subtract from the following fractions to obtain 1 ?

$\frac{3}{4}$, $\frac{4}{3}$, $\frac{4}{5}$, $\frac{4}{7}$, $\frac{5}{6}$, $\frac{7}{4}$, $\frac{6}{11}$, $\frac{11}{6}$, $\frac{5}{12}$, $\frac{17}{12}$, $\frac{5}{8}$, $\frac{8}{5}$.

Example : $1\frac{1}{2}+2\frac{3}{4}+1\frac{5}{6}$

$1\frac{1}{2}=1\frac{6}{12}$ $\frac{6}{12}+\frac{9}{12}+\frac{10}{12}=25$ twelfths

$2\frac{3}{4}=2\frac{9}{12}$ $=2$ whole and 1 twelfth $=2\frac{1}{12}$;

$1\frac{5}{6}=1\frac{10}{12}$ put down $\frac{1}{12}$ and carry 2.

$6\frac{1}{12}$ *Ans.*

11. Add :

(*a*) $1\frac{1}{2}+2\frac{5}{6}+1\frac{1}{12}$
(*b*) $2\frac{3}{4}+1\frac{1}{4}+3\frac{5}{12}$
(*c*) $4\frac{1}{3}+2\frac{5}{6}+3\frac{1}{4}$
(*d*) $5\frac{2}{3}+3\frac{1}{4}+6\frac{5}{6}$
(*e*) $7\frac{1}{2}+2\frac{1}{4}+1\frac{3}{4}$
(*f*) $7\frac{1}{4}+1\frac{3}{4}+1\frac{5}{6}$
(*g*) $2\frac{1}{3}+3\frac{1}{6}+2\frac{11}{12}$
(*h*) $3\frac{5}{6}+4\frac{11}{12}+7\frac{2}{3}$

Example 1.

Take $2\frac{3}{4}$ from $4\frac{2}{3}$

$4\frac{2}{3}=4\frac{8}{12}$ Since 9 cannot be taken from 8, and 12 twelfths to the 8 twelfths making it 20 tewelfths.

$2\frac{3}{4}=2\frac{9}{12}$ $\frac{20}{12}-\frac{9}{12}=\frac{11}{12}$

$1\frac{11}{12}$

Example 2. $7\frac{1}{2}-4\frac{2}{3}$

$7\frac{1}{2}=7\frac{6}{12}$ Add 12 twelfths to 6 twelfths making it 18 twelfths.

$\frac{18}{12}-\frac{8}{12}=\frac{10}{12}$

$4\frac{2}{3}=4\frac{8}{12}$

$2\frac{10}{12}$ or $2\frac{5}{6}$ *Ans.*

12. (*a*) $6\frac{1}{3}-4\frac{1}{6}$;
(*b*) $3\frac{2}{3}-1\frac{1}{12}$;
(*c*) $4\frac{1}{2}-2\frac{1}{3}$;
(*d*) $4\frac{3}{4}-2\frac{11}{12}$;
(*e*) $5\frac{1}{4}-3\frac{7}{12}$;
(*f*) $8\frac{7}{12}-6\frac{3}{4}$
(*g*) $6\frac{1}{12}-3\frac{2}{3}$
(*h*) $8\frac{1}{4}-3\frac{5}{6}$
(*i*) $1\frac{2}{3}+3\frac{1}{4}+1\frac{7}{12}$
(*j*) $8\frac{1}{3}+4\frac{1}{6}-7\frac{3}{4}$

Fractions of quantities

Fill in the following blank as done in the example.

Example : $\frac{1}{2}$ of 1 hour $=\frac{1}{2}$ of 60 min. $=$ 30 min.
$\frac{1}{3}$ of 1 hour $=$ min. $=$ min.
$\frac{1}{4}$ of 1 hour $=$ min. $=$ min.
$\frac{1}{6}$ of 1 hour $=$ min. $=$ min.
$\frac{1}{5}$ of 1 hour $=$ min. $=$ min.
$\frac{1}{12}$ of 1 hour $=$ min. $=$ min.
$\frac{2}{3}$ of 1 hour $=$ min. $=$ min.
$\frac{1}{10}$ of 1 hour $=$ min. $=$ min.
$\frac{3}{10}$ of 1 hour $=$ min. $=$ min.
$\frac{9}{10}$ of 1 hour $=$ min. $=$ min.
$\frac{7}{12}$ of 1 hour $=$ min. $=$ min.
$\frac{4}{5}$ of 1 hour $=$ min. $=$ min.

Examples :

(*a*) To find $\frac{5}{9}$ of Rs 72.
$\frac{1}{9}$ of Rs 72 $=$ Rs 72 $\div$ 9 $=$ Rs 8.00
So of Rs 72 $=$ Rs 5 $\times$ 8 $=$ Rs 40.00.

(*b*) To find $\frac{11}{6}$ of 174 Kg.
$\frac{1}{6}$ of 174 Kg. $=$ 174 $\div$ 6 $=$ 29 Kg.
So $\frac{11}{6}$ of 174 Kg. $=$ 11 Kg. $\times$ 29 $=$ 319 Kg.

Exercises 32

Find :

(*a*) $\frac{3}{4}$ of 72 Kg.
(*b*) $\frac{3}{5}$ of 48 metres
(*c*) $\frac{5}{6}$ of 54 litres
(*d*) $\frac{7}{8}$ of 96 minutes
(*e*) $\frac{3}{10}$ of 40 hours
(*f*) $\frac{7}{12}$ of 84 grams
(*g*) $\frac{9}{16}$ of 112 litres
(*h*) $\frac{3}{7}$ of 42 sec.
(*i*) $\frac{5}{9}$ of 108 Kg.
(*j*) $\frac{11}{12}$ of 114 metres
(*k*) $\frac{4}{3}$ of 72 metres
(*l*) $\frac{5}{4}$ of 36 litres
(*m*) $\frac{6}{5}$ of 80 min.
(*n*) $\frac{12}{7}$ of 84 hours
(*o*) $\frac{16}{9}$ of 144 cm.
(*p*) $\frac{12}{9}$ of 108 gm.
(*q*) $\frac{16}{7}$ of 77 litres
(*r*) $\frac{11}{8}$ of 104 rupees
(*s*) $\frac{15}{8}$ of 48 paise
(*t*) $\frac{12}{7}$ of 112 rupees

Multiplication of Fraction by a whole number

Examples (*i*) $\frac{3}{5}\times 6=\frac{3\times 6}{5}=\frac{18}{5}=3\frac{3}{5}$

(*ii*) $\frac{2}{3}\times 8=\frac{2\times 8}{3}=\frac{16}{3}=5\frac{1}{3}$

(*iii*) $\frac{5}{6}\times 12=\frac{5\times\cancel{6}\times\overset{1}{2}}{\underset{1}{\cancel{6}}}=10$

In Example (*iii*) we *avoid* unnecessary working *by cancelling* above and below any common factor before multiplying.

(*iv*) $2\frac{3}{10}\times 4$

$=\frac{23}{10}\times 4.$ (We have changed the mixed number $2\frac{3}{10}$ into the improper fraction $\frac{23}{10}$.)

So $\frac{23}{\underset{5}{\cancel{10}}}\times\frac{\overset{2}{\cancel{4}}}{1}=\frac{23\times 2}{5}=\frac{46}{5}=9\frac{1}{5}$ *Ans.*

Exercises 33

(*a*) $\frac{3}{4}\times 3$
(*b*) $\frac{4}{5}\times 8$
(*c*) $\frac{5}{6}\times 7$
(*d*) $\frac{1}{2}\times 5$
(*e*) $\frac{2}{3}\times 9$
(*f*) $\frac{8}{7}\times 21$
(*g*) $\frac{5}{9}\times 36$
(*h*) $\frac{7}{12}\times 48$
(*i*) $\frac{6}{7}\times 49$
(*j*) $\frac{3}{8}\times 8$

(*k*) $2\frac{1}{3}\times 12$
(*l*) $2\frac{3}{10}\times 4$
(*m*) $1\frac{5}{6}\times 7$
(*n*) $3\frac{2}{3}\times 15$
(*o*) $4\frac{5}{9}\times 12$
(*p*) $2\frac{5}{8}\times 8$
(*q*) $2\frac{4}{9}\times 6$
(*r*) $6\frac{3}{8}\times 6$
(*s*) $5\frac{5}{12}\times 16$
(*t*) $8\frac{3}{15}\times 10$

Nos. (1)-(14) are suitable for oral work.

Simplify :

(1) 3 sevenths + 2 sevenths (2) 4 twelfths + 5 twelfths

(3) 3 ninths + 2 ninths (4) 3 tenths + 4 tenths

(5) 8 tenths + 8 tenths) (6) 7 ninths + 7 ninths

(7) $\frac{4}{11}+\frac{6}{11}$ (8) $\frac{2}{8}+\frac{3}{8}$ (9) $\frac{1}{9}+\frac{1}{9}$ (10) $\frac{3}{7}+\frac{3}{7}$

(11) $\frac{3}{16}+\frac{7}{16}$ (12) $\frac{4}{15}+\frac{7}{15}$ (13) $\frac{7}{20}+\frac{8}{20}$ (14) $\frac{6}{21}+\frac{13}{21}$

(15) $\frac{1}{2}+\frac{1}{8}$ (16) $\frac{1}{3}+\frac{1}{6}$ (17) $\frac{1}{5}+\frac{7}{10}$ (18) $\frac{4}{9}+\frac{5}{9}$

(19) $\frac{1}{3}+\frac{5}{6}+\frac{3}{12}$ (20) $\frac{1}{3}-\frac{1}{6}$ (21) $\frac{5}{12}-\frac{1}{3}$ (22) $\frac{3}{8}-\frac{1}{4}$

(23) $2\frac{1}{2}+3\frac{1}{6}+4\frac{1}{2}$ (24) $2\frac{1}{3}+5\frac{2}{3}+4\frac{1}{3}$ (25) $1\frac{7}{8}+2\frac{1}{4}+3\frac{1}{2}$

(26) $\frac{2}{3}+\frac{5}{6}+\frac{3}{4}$ (27) $7\frac{5}{8}+3\frac{1}{4}+6\frac{1}{8}$ (28) $1\frac{7}{8}+2\frac{1}{4}+2\frac{1}{2}$

(29) $\frac{2}{3}+\frac{5}{6}+\frac{3}{4}+\frac{5}{12}$ (30) $\frac{1}{4}+7\frac{1}{3}+8\frac{1}{2}$ (31) $\frac{1}{2}-\frac{1}{6}+\frac{1}{3}$

(32) $\frac{7}{10}-\frac{2}{5}+3\frac{1}{2}$ (33) $1\frac{1}{3}-\frac{5}{6}+\frac{1}{2}$ (34) $3\frac{1}{4}+\frac{5}{12}-\frac{1}{3}$

(35) $\frac{2}{3}+\frac{5}{6}-\frac{7}{12}$ (36) $4-\frac{3}{5}-\frac{7}{10}$ (37) $\frac{8}{5}-\frac{8}{10}$

(38) $\frac{11}{6}-\frac{2}{3}$ (39) $\frac{5}{4}-\frac{5}{8}$ (40) $2\frac{3}{4}+3\frac{1}{12}+5\frac{1}{6}-8\frac{2}{3}$

(41) $\frac{3}{5}\times2$ (42) $\frac{4}{7}\times14$ (43) $2\frac{1}{5}\times4$ (44) $\frac{8}{3}\times12$

(45) $7\frac{2}{3}\times6$ (46) $3\frac{4}{10}\times6$ (47) $8\frac{3}{8}\times12$ (48) $3\frac{5}{6}\times4$

(49) $2\frac{5}{8}\times6$ (50) $9\frac{4}{7}\times21$ (51) $(\frac{3}{5}\times5)$Rs (52) $\frac{4}{5}$ of 1hour

(53) $\frac{3}{4}$ of 64 gm. (54) $\frac{3}{8}$ of 16 litres (55) $\frac{5}{7}$ of 28 Rs

(56) $\frac{7}{8}$ of 56 metres (57) $\frac{7}{12}$ of 72 Km. (58) $\frac{5}{9}$ of 72 Kg.

(59) $\frac{5}{6}$ of 42 Rs (60) $\frac{3}{7}$ of 63 minutes.

1. If 3 cups of lime juice are mixed with 9 cups of water, what fraction of the whole drink is lime juice ?

2. A hockey team is made up of 7 boys, and the rest masters. What fraction of the team are boys ?

3. John received a parcel of a dozen mangoes. Three of them were over-ripe. What fraction of the parcel was good ?

4. John spent $\frac{1}{3}$ of his pocket money on sweets, $\frac{1}{6}$ on stamps. What fraction of his pocket money has he left ?

5. A man sleeps 8 hours a day, what fraction of the day does he sleep ?

6. A boy spends 6 hours in school. What fraction of the day is he away from school ?

7. A Kilogram of tobacco costs Rs 56. What is the cost of $\frac{3}{4}$ Kg. of tobacco ?

8. A man weeds $\frac{2}{3}$ of a field in 12 days. How long will he take to weed $\frac{1}{3}$ of the field ? How long will he take to weed the whole field ?

9. Two boys share Rs 15. One of them takes $\frac{3}{5}$ of the money. How many rupees does the other get ?

10. John has $\frac{3}{5}$ Kg. of sweets, Tom has $\frac{1}{2}$ Kg., Harry $\frac{1}{8}$ Kg. more than John and Tom together. How much has Harry ?

11. I give 17 workmen each $1\frac{3}{8}$ Kg. of rice. How much rice have I given out altogether ?

12. A Kilogram of sweets was shared equally among 3 boys. What fraction of a Kg. less would each have got if another boy had joined them ?

Example 1.

Divide 96 marbles between two boys, giving one boy two shares to the other's one.

First divide 96 into 3 equal shares of 32.

Give one boy two shares, that is 32×2.

That boy gets 64 marbles.

The other gets one share, that is 32 marbles.

Ans. One boy gets 64 marbles, the other gets 32.

Check : $64+32=96$.

Example 2.

Divide 17 pictures between Tom and Mary so that Tom has 3 more than Mary.

Give 3 to Tom; the remainder$=(17—3)$ pictures$=14$ pictures. Divide these equally. Therefore Mary has $(14 \div 2)$ pictures, that is 7 pictures.

Tom has $(7+3)$ pictures, that is 10 pictures.

Check the solution.

Exercises 34

1. Divide Rs 126·00 between two men, giving one man two shares to the other's one.

2. Divide Rs 363·00 between two men so that one man may get twice as much as the other.

3. Share 250 lb. of sugar between two bags so that one bag may have 2 shares to the other's 3.

4. If the Arithmetic lesson is to be given twice the amount of time that is given to Dictation, how will you divide 54 minutes between the two lessons ?

5. Mr Smith is half his father's age. Their ages added together amount to 75 years. Now old is Mr Smith ?

6. Mr Jones is twice as old as his son. Their ages added together total 96 years. How old is Mr Jones ?

7. Last September we had twice as many rainy days as dry days. How many rainy days had we ?

8. It takes me twice as long to walk from my house to the school as it does to walk from the school to the station. It if takes me 42 minutes to walk to the station *via* the school, how long will it take me to walk from my house to the school?

9. Divide Rs 380·00 between three men, giving one of them Rs 20 more than the others.

10. Divide Rs 460·00 between three men, giving one of them Rs 20·00 less than the others.

11. Divide 21 lb. of sweets into two parcels so that one parcel may contain twice as much as the other.

12. Five boys tied for a prize of Rs. 26·40 and had to divide it equally. How much less would each had received, if seven had tied?

13. Harry has 100 stamps more than Tom. If Harry gives Tom 200 stamps, how many more will Tom have than Harry ?

14. If cycles cost Rs 175·25 each, how much less will a trader have to pay for 75 of them than for 78?

15. The 17th July of a certain year fell on a Friday. What day of the week was the 3rd August ?

16. When seven boxes of equal weight are put on a weighting machine, the pointer points to 5 md. 10 sr. What will the pointer show when 3 boxes are taken off?

17. When twenty-three bags of sweets of equal weight are put on a weighting machine, the pointer points to 70 lb. 7 oz. What does each bag of sweets weight ?

18. Twenty marbles can be exchanged for three tops, and six stamps for four tops. How many stamps can be had in exchange for 80 marbles?

We shall in future write $2 \times a$ or $a \times 2$ as $2a$.

$3 \times a$ or $a \times 3$ will be written as $3a$.

How can $c \times 4$ be written more shortly?

How can $d \times 3$ be written more shortly?

In ordinary number work, 34 means 3 tens and 4, or thirty-four.

In code, $3a$ does not mean 3 tens and a, but 3 times a or $3 \times a$ or $a \times 3$.

Exercises 35

If $a=3$, $b=5$, for what numbers do these stand?

1. $4a$
2. $3b$
3. $6a$
4. $12b$
5. $8a$
6. $9b$
7. ab
8. ba
9. $a+b$
10. $b-a$
11. $2a+b$
12. $a+2b$
13. $2a+2b$
14. $7a-4b$
15. $7a+b$
16. $6a+2b$
17. $5a-3b$
18. $ab+4a$

19. $a+4$
20. $2a+4$
21. $b-3$
22. $5-a$
23. $2b-a$
24. $3b+4$
25. $4a+6$
26. $3a-9$
27. $3a+9$
28. $3a+9b$
29. $4a-2b$
30. $a+6b$
31. $6a+b$
32. $6a+9$
33. $a+b+6$
34. $b-a+6$
35. $ab+6$
36. $ab-11$

37. A class of nine girls was asked to write the number 8 in code. The code used was $a=3$, $b=2$, $c=5$. The following answers were given. Which of them were right?

	Ans.		*Ans.*		*Ans.*
1st girl	$a+c$	4th girl	$a+5$	7th girl	$4c-6b$
2nd „	$2a+b$	5th „	$b+c+1$	8th „	$5b-3$
3rd „	$a+3b$	6th „	$ab+2$	9th „	$ab-b$

Brackets

How are we to write, using the signs $+$ and $\times$,

'Add 3 to 4; then multiply the sum by 8'?

We cannot write this as $3+4\times8$, because, as we have already seen, $\times$ must be done before $+$ and *this* would, therefore, mean 'First multiply 4 by 8; then add the product to 3.'

'Add 3 to 4; then multiply the sum by 8,' should be written as $(3+4)\times8$.

A bracket is *always* worked first.

In the same way, 'Subtract 7 from 12 and multiply the difference by 6,' is written as $(12-7)\times6$.

Exercises 36

Work these out:

1. $(3+7)\times5$
2. $3+7\times5$
3. $18-6\times2$
4. $(18-6)\times2$
5. $11\times(6+2)$
6. $11\times6+2$
7. $12+(7-5)$
8. $12+7-5$
9. $19+7\times3$
10. $19+(7\times3)$
11. $(19+7)\times3$
12. $(3+4)\times(7+5)$

If $a=7$, $b=5$, find:

13. $a\times b+4$
14. $(a+b)\times6$
15. $a-b+8$
16. $(2a-b)\times3$
17. $(a+2b)\times2$
18. $(3+b)\times a$
19. $(a+3)+b$
20. $a+3b$
21. $(a+b)\times a$

Rewrite, using signs:

22. Add 3 and 7 and multiply the answer by 11.
23. Multiply 7 by 11 and add 3 to the product.
24. Subtract 7 from 12 and multiply the difference by 6.
25. Multiply the difference between 12 and 5 by 9.
26. Multiply 5 by 9 and take 12 from the answer.

27. Add *a* and *b* and multiply the answer by 7.
28. Add *a* to the product of *b* and 7.

Prime Factors

Factors. $36=4\times9$, 4 and 9 are each called factors of 36, and 36 is called a multiple of 4 as also a multiple of 9.

$7\times3=21$, so 21 is a multiple of 3 and 7; 9, 18, 27, 36, 45, are, besides innumerable others, five multiples of 9.

Any whole number which has 2 as a factor is called EVEN. Whole numbers which are not EVEN are called ODD. 2, 4, 6, 8, .. 36, .. 44. . . .are even numbers, and 1, 3, 5, 7, .. 21, .. 29, .. 37 .. are odd numbers.

Oral

1. Complete the following :

$48=4\times$ . . . . . ; $72=8\times$ . . . . ; $64=8\times$ . . . .
$108=9\times$ . . . . ; $112=16\times$ . . . . ; $132=11\times$ . . . .
$42=2\times3\times$ . . . . ; $180=10\times2\times$ . . . .
$120=4\times6\times$ . . . . ; $165=11\times5\times$ . . . .
$130=2\times5\times$ . . . . ; $196=4\times7\times$ . . . .

2. What are the multiples of 4 which are less than 30 ?
What are the multiples of 5 which are less than 32 ?
What are the multiples of 9 which are less than 50 ?

Tests of Divisibility.

(*a*) A number is divisible by 2 if it is even, e.g. 46.

(*b*) A number is divisible by 3 if the sum of its digits is divisible by 3, e.g. 471. ($4+7+1=12$, $12\div3=4$).

(*c*) A number is divisible by 5 if the last digit is 5 or 0.

(*d*) A number is divisible by 9 if the sum of its digit is divisible by 9, e.g. 585. ($5+8+5=18\div9=2$).

Prime numbers: A whole number is called prime if it is divisible only by itself and 1, but by no other whole number.

Thus 2, 3, 5, 7, 11, 13, 17, 19, 23, ... and so on are prime numbers. Any whole number which is not a prime number can be broken up into factors of two or more prime numbers, *i.e.* into PRIME FACTORS.

Example : $36 = 2 \times 2 \times 3 \times 3$

$$\begin{array}{r)r} 2 & 36 \\ \hline 2 & 18 \\ \hline 2 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

Whenever a number is to be split into prime factors, it is best to do it in the proper order. Always take the prime numbers from the lowest, that is 2, 3, 5, 7, 11, 13 ....and divide as often as possible by any one before going on to the next.

Example 1. Express 240 in prime factors.

$$\begin{array}{r)r} 2 & 240 \\ \hline 2 & 120 \\ \hline 2 & 60 \\ \hline 2 & 30 \\ \hline 3 & 15 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

Ans. $240 = 2 \times 2 \times 2 \times 2 \times 3 \times 5$

Note : $2 \times 2 \times 2$ is written for short as 2^3. Here 3 is called the index of 2.

$2 \times 2 \times 2 \times 3 \times 2$ is written for short as $2^3 \times 3^2$.

Here the index of 2 is 3 and 2 is the index of 3.

Example 2. Express 3528 in prime factors.

$$\begin{array}{r)r} 2 & 3528 \\ \hline 2 & 1764 \\ \hline 2 & 882 \\ \hline 3 & 441 \\ \hline 3 & 147 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

Ans. $3528 = 2 \times 2 \times 2 \times 3 \times 3 \times 7 \times 7$

or $2^3 \times 3^2 \times 7^2$ (answer written in index form).

Exercises 37

Express the following numbers in prime factors in index form :

1. 12
2. 24
3. 36
4. 48
5. 35
6. 45
7. 75
8. 111
9. 125
10. 144
11. 196
12. 225
13. 256
14. 484
15. 300
16. 294
17. 400
18. 405
19. 440
20. 450
21. 528
22. 363
23. 693
24. 676
25. 792
26. 1008
27. 1050
28. 2310
29. 1764
30. 3016

H.C.F. and L.C.M.

Highest Common Factor

A number which is a factor of two or more given numbers is called a **common factor** of these numbers.

$$24=4\times 6$$
$$42=6\times 7$$

Here 6 is a common factor of 24 and 42. Also 2 and 3 are common factors of 24 and 42.

The **greatest number** which is a common factor of two or more given numbers is called their HIGHEST COMMON FACTOR or for short their H.C.F. In the above example, 6 is the Highest Common Factor.

The H.C.F. can be found by prime factors.

Example 1. Find the H.C.F. of 24, 42 and 58.

$24=2\times 2\times 2\times 3$
$42=2\times 3\times 7$
$58=2\times 29$
H.C.F.$=2$

2 is a factor of 24, 42, 58
3 is a factor of 24 and 42 only.
7 is a factor of 42 alone.
29 is a factor of 58 alone.
So the highest Common Factor is 2.

Example 2. Find the H.C.F. of 36, 56, 76

$36=2\times2\times3\times3=2^2\times3^2$

$56=2\times2\times2\times7=2^3\times7$

$76=2\times2\times19 \quad =2^2\times19$

H.C.F. $=2^2$

or 4

Ans. 2^2 or 4.

2^2 is the Highest Common Factor, as the others are not common factors or factors of all the three numbers.

Exercises 38

Find by prime factors the H.C.F. of:

1. 12, 32
2. 10, 30
3. 12, 20, 30
4. 6, 10, 14
5. 21, 28
6. 27, 45, 63
7. 10, 21, 66
8. 9, 42, 77
9. 24, 42, 78
10. 60, 108
11. 84, 105, 119
12. 72, 168, 216
13. 144, 432, 648
14. 108, 162, 270
15. 44, 77, 99
16. 132, 154, 198
17. 165, 231, 264
18. 84, 210, 420, 462
19. 546, 882, 924
20. 196, 350, 728, 924

Least Common Multiple

A number which is a multiple of two or more given numbers is called a **Common multiple** of these numbers.

42 is a common multiple of 3, 7, 21 and 42.

Again 84, 126, 168, etc. are common multiples of 3, 7, 21 and 42.

The least number which is a common multiple of two or more given numbers is called their **Least Common Multiple** or for short L.C..M.

42, 84, 126,....are common multiples of 3, 7, 21 and 42, but 42 only is the L.C.M. of 3, 7, 21 and 42.

Example 1. Find by prime factors the L.C.M. of 4, 6, 9.

$4=2^2$

$6=2\times3$

$9=3^2$

L.C.M. $=2^2\times3^2=4\times9=36$

36 is a miltiple of 4, 6 and 9 and it is the lowest multiple of all the three numbers.

It is usually best to leave the L.C.M. in factors.

Example 2. Find by prime factors the L.C.M. of

16, 28, 252.

$16=2^4$

$28=2^2\times7$

$252=2^2\times3^2\times7$

L.C.M. $=2^2\times3^2\times7$

We find here that every common multiple must have 2, 3, 7 as factors and each of these factors must be to the highest index as it is found in any of the numbers. The highest index of 2 is 2^4, the highest index of 3 is 3^2, and the highest index of 7 is 7. So the L.C.M. is $2^4\times3^2\times7$.

Exercises 39

Nos 1-5 may be taken as oral work.

1. Write down (*a*) 3 multiples of 3
   (*b*) 4 multiples of 5
   (*c*) 4 multiples of 8
   (*d*) 3 multiples of 7
2. Write down 5 multiples of 4 and 3 multiples of 6. What is the L.C.M. of 4 and 6 ?
3. Write down 3 common multiples of 15 and 10. What is the L.C.M. of 15 and 10 ?
4. Write down 2 multiples of 4 which are also multiples of 9. What is the L.C.M. of 4 and 9 ?
5. Write down the L.C.M. of (*a*) 8 and 10, (*b*) 9 and 12. (*c*) 6 and 9, (*d*) 7 and 14, (*e*) 4, 8, 16 and (*f*) 3, 4, 9.

Write down in index form the L.C.M. of :

6. $2^3\times3^2$, $2^3\times3$
7. $2^3\times3$, $2^2\times3^2$, $2^4\times3^3$
8. $2^2\times3^3\times5$, $2^3\times3^2\times5$

9. $3^2 \times 5^2 \times 7$, $2 \times 3^3 \times 5 \times 7^2$
10. $2^4 \times 5$, 5^3
11. 2×3^3, $2^4 \times 3$, $2^5 \times 3^4$, $2^3 \times 3^2 \times 5$
12. 3, 5, 9
13. 6, 9, 15
14. 4, 10, 15
15. 12, 15, 18
16. 8, 15, 20
17. 5, 6, 10
18. 4, 7, 12 14
19. 6, 15, 20
20. 18, 24, 56
21. 15, 18, 42
22. 32, 84, 40
23. 36, 54, 120
24. 36, 63, 98
25. 48, 56, 105, 225
26. 36, 63, 77
27. 39, 52, 91
28. 132, 176, 220
29. 21, 33, 63, 121
30. 8,20,48,308,450

Averages

If a man spends Rs 70 in a week, then we can say that his **average daily spending** is Rs $70 \div 7$ *i.e.* Rs 10. This does not mean that he actually spends Rs 10 each day, but that his total spending each week is the same as if he spent Rs 10 every day.

A train does 240 miles in 8 hours, so its **average** speed is $240 \div 8$ that is 30 miles per hour. This does not mean the train actually does 30 miles in every hour, but that the time taken is the same as if the train did 30 miles every hour.

Example 1.

A cricketer scores 17, 34, 12, 21, 46 runs respectively in 5 innings, being out each time. Find his average score ?

He scores $17+34+12+21+46$ runs in 5 innings.

$\therefore$ His total score 130 runs.

The number of innings is 5.

$\therefore$ His average score is $\frac{130}{5}=26$ runs.

Example 2.

John's marks in English in 6 tests are 46, 56, 64, 31, 40 and 46. Find his average marks.

John's total marks $=45+56+64+31+40+46=282$

Number of tests is 6

$\therefore$ His average marks are $282 \div 6 = 47$

$$\begin{array}{r} 6)282 \\ \hline 47 \end{array}$$

Ans. 47 marks.

So we can make a rule for finding averages :

$$\text{Average} = \frac{\text{Total of quantities}}{\text{Number of quantities}}$$

Exercises 40

1. Find the averages of :

(*a*) 3, 4, 7, 11, 15 (*b*) 7, 15, 12, 9, 8, 25, 14

(*c*) 6·5 cm, 6·1 cm, 6·2 cm, 6·4 cm, 6·3 cm.

2. A cricketer scores 48, 59, 72, 5, 48, 80, 66 runs in 7 completed innings. What is his average score ?

3. In a class Ann's marks are 72, 48, 63, 71, 15, 35, 32; and Mary's marks are 47, 84, 55, 62, 18, 47, 30. Find the average marks of each girl. Who has got the better average ?

4. One goods train does a distance of 168 Kilometres in 8 hours and another goods train does 260 Kilometres in 13 hours. Which train travels faster ?

5. The total rainfall every month for Bombay and Calcutta are given below. Find which town has a better average rainfall per month.

	Bombay	Calcutta
May	25 cm.	18 cm.
June	82 cm.	79 cm.
July	99 cm.	85 cm.
August	121 cm.	96 cm.
September	84 cm.	98 cm.
October	21 cm.	47 cm.

6. The average age of a class of 12 children is 10 years 3 months. What is the total age of the class ?

7. A cyclist travels for 2 hours at 13 Km. per hour and for 3 hours at 8 Km. per hour. Find his average speed for the whole journey.

8. A man buys 3 saucepans at Rs 6 each and 4 saucepans at Rs 4.25 each find the average price of a saucepan.

9. 16 ice cream cones weigh 240 gms. What is the average weight of a cone ?

10. The average weight of a group of 7 boys is 48 Kg. and the average weight of 6 of the boys is 47 Kg. What is the weight of the seventh boy ?

11. A shopkeeper's sales from Monday to Friday were respectively Rs 375, Rs 425, Rs 394, Rs. 408, Rs 313. If his average sales for the week is Rs 357, what were the sales for Saturday ? (Sunday is a holiday).

12. A boy swims 8 lengths of a swimming bath in 2 mins. His average timing for the first seven lengths is 14.7 secs. In what time does he do the eighth length ?

The Method of One

Direct Proportion

Example 1.

Seven books cost Rs. 21. What do eleven books cost ?

7 books cost Rs 21

∴ 1 book costs Rs $\frac{21}{7}$ ($\frac{1}{7}$ of 21)

∴ 11 books cost Rs $\frac{\overset{3}{\cancel{21}}}{\cancel{7}}\times 11$ (11 times the cost of one book)

$=$Rs $3\times 11=$Rs 33

Always write what is given by a PROPER SENTENCE and arrange it so that the quantity which is to be found is at the end of the sentence or on the right hand side.

Example 2.

5 equal bags of sugar weigh 70 Kg; how many such bags are required for 112 Kg. ?

70 kg. is the weight of 5 bags

∴ 1 Kg. is the weight of $\frac{5}{70}$ bags

∴ 112 Kg. is the weight of $\frac{\cancel{5}}{\underset{\underset{2}{\cancel{14}}}{\cancel{70}}} \times \overset{\overset{8}{\cancel{16}}}{\cancel{112}} = 8$ bags.

Execises 41

1. For 6 necklaces 348 beads are needed. How many beads will be needed for 9 necklaces ?

2. Seven cricket bats cost Rs 168·00. What will eleven cricket bats cost ?

3. Twelve motor cars cost Rs 144000·00. What will eight motor cars cost ?

4. Eight shelves will hold exactly 128 equal-sized books. How many such books will 15 shelves hold ?

5. Just nine buses are needed for 207 passengers. How many passengers will 5 buses take ?

6. Eight baskets will hold 296 apples. How many apples will eleven baskets hold ?

7. Nine copies of a History book cost Rs 36·00. What will 12 copies cost ?

8. In 9 minutes an aeroplane flies 36 Kilometres. How far does it fly in 12 minutes ?

9. Nine drums hold 864 litres of oil. How many litres will seven such drums hold ?

10. 15 equal bags of coal weigh 210 Kg. How many such bags will weigh 70 Kg. ?

11. Twelve radio sets cost Rs 4800. How many such sets can be obtained for Rs 7200 ?

12. Eighteen tins of sweets cost Rs 126. How many such tins can be bought for Rs 315 ?

13. Fifteen chickens can be bought for Rs 65. How many can be bought for Rs 39 ?

14. Sixteen jugs of milk fill 176 cups. How many jugs of milk will be required to fill 275 cups ?

15. 14 tables cost Rs 546. What do 27 tables cost ?

16. A man saves Rs 42 in 7 weeks. How many weeks will he take to save Rs 216 at the same rate ?

Inverse Proportion

Example 1.

3 men weed a garden in 8 hours. How long will 4 men take, if all of them work at the same rate ?

3 men weed the garden in 8 hours.

(But 1 man will take 3 times as long as 3 men take.)

∴ 1 man weeds the garden in 3×8 hours.

(4 men will take one quarter of the time 1 man takes.)

∴ 4 men will weed the garden in $\frac{3\times\overset{2}{\cancel{8}}}{\cancel{4}} = 6$ hours.

The sentences in brackets show how the sum is to be argued mentally. These sentences should not be written down.

Exercises 42

1. 2 men clean a wall in 1 hour. How long will one man take, working at the same rate ?

2. 3 cooks clean a basket of potatoes in 25 minutes. How long will one man take, working at the same rate ?

3. 4 boys paint a wall in 3 hours. How long will one boy take, working at the same rate ?

4. 2 taps fully opened fill a tub in 20 minutes. How long will one tap take to fill the tub ?

N.B. Assume the rates are the same.

5. 5 men build a wall in 8 days. How long will it take 1 man ? 2 men ? 4 men ?

6. 4 taps running at the same rate fill a cistern in 15 minutes. How long will 1 tap take ? 3 taps take ? 5 taps take ?

7. Two masons can whitewash a dormitory in 150 mins. How long will one mason take ? 3 masons take ? 6 masons take ?

8. 15 men mend a road in 27 days. How long will 9 men take to mend it ?

9. There is enough hay to feed 8 horses in 15 days. How long will it last for 1 horse ? 5 horses ? 12 horses ?

10. A boy takes 20 minutes to walk to school when he walks at the rate of 3 Km. an hour. How long will he take if he walks at 4 Km. an hour ?

11. Twenty soldiers in camp have sufficient food to last them 25 days. How long will the same quantity of food last 25 soldiers ?

12. Six water pumps working together fill a swimming bath in 12 hours. How many pumps are working together if the bath is filled in 9 hours ?

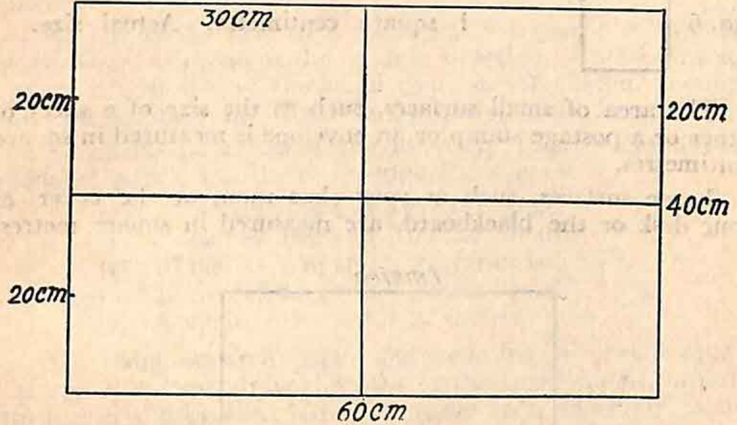


FIG. 5

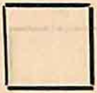
John is given a sheet of cardboard 30 cm. long and 20 cm. broad, and Mary has a cardboard 60 cm. long and 40 cm. broad. Marry said, 'My cardboard is 60 cm. long and 40 cm. wide. So my cardboard is twice as broad as yours, therefore my cardboard is twice the size of yours.' Was she right in saying her cardboard was twice the size of John's ? Look at the figure and you will find that she was wrong. Mary's cardboard is 4 times as large as John's cardboard.

When we speak of the size of a piece of cardboard we are thinking of the **surface** of the cardboard. When we speak of the "size" of a line we say "length". Instead of using the word "size" when we speak of a surface, we say AREA.

Imagine a square each side of which is a centimetre long. The **area** of the square is called a square centimetre. Just as we use a centimetre to measure lengths, we use a square centimetre to measure areas.

Here is the actual size of a square centimetre :

FIG. 6



1 square centimetre. Actual size.

The area of small surfaces, such as the size of a sheet of paper or a postage stamp or an envelope is measured in square centimetres.

Large surfaces, such as your class room or the cover of your desk or the blackboard, are measured in square metres.

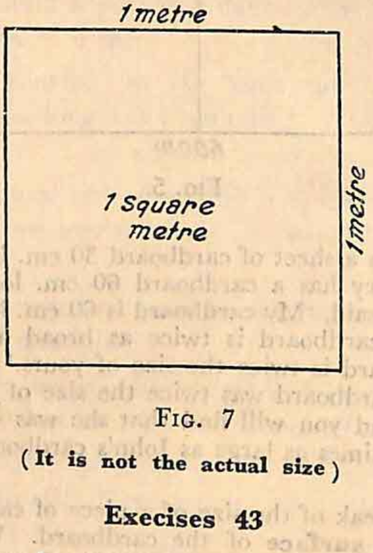


FIG. 7

(It is not the actual size)

Execises 43

Use cm. squared paper to do the following exercises.

1. Draw a plan of a room 7 metres long and 5 metres wide. Count the side of a small square as 1 metre. For what area will each small square stand ? How many small squares are there in your plan ? What is the area of the room ? Your answer must be given in square metres ?

2. Draw the plan of a room 10 metres long and 7 metres broad. What is the area of the room in square metres ?

3. Draw the plan of a school hall 15 metres long and

12 metres wide. Write down the area of the room in sauare metres.

4. Draw the plan of a room which is twice as long and three times as broad as the room in question. Into how many rooms of the size of the small room can the large room be divided ? Show the divisions by dotted lines in your plan.

5. Find the areas of the following rooms. Do not use squared paper, but try to imagine the squares

(*a*) 8 metres long and 5 metres broad.
(*b*) 9 metres long and 7 metres broad.
(*c*) 10 metres long and 9 metres broad.
(*d*) 12 metres long and 9 metres broad.
(*e*) A square field of side 22 metres.

6. Using squared paper and counting the small squares as square metres, draw the plan of the three rooms, different in length and breadth but of the same area, 48 square metres. Write down the perimeter (measurement around) of each rectangle.

7.

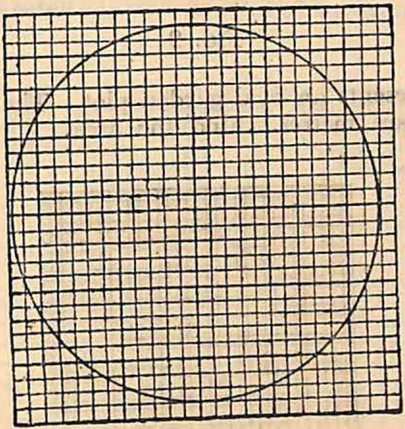


FIG. 8

Fig. 8 is the plan of a circular pond. The small squares represent square metres. Count up the small squares in the circle. Count the parts of squares that lie along the boundary as whole squares, if they are more than a half. Leave them out, if they are less than a half. Write down the area of the pond.

8.

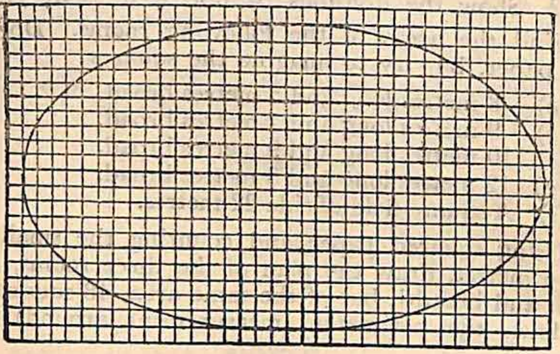


FIG. 9

Fig. 9 represents an oval garden plot. The small squares represent square metres. Find the area.

9.

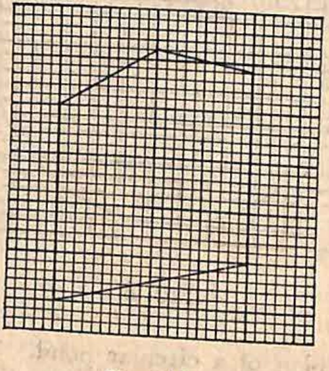


FIG. 10

Fig. 10 represents the plan of a field. The small squares represent square metres. Find the area.

10.

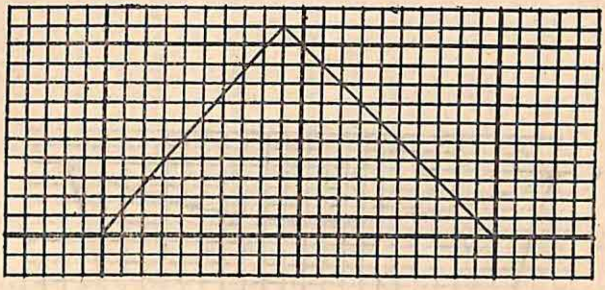
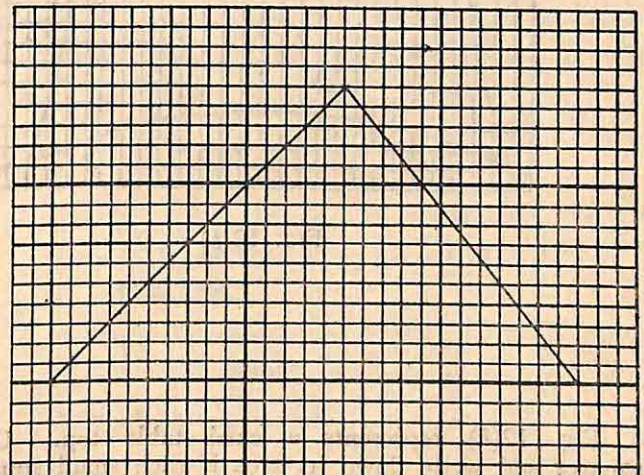


FIG. 11

Fig. 11 represents a triangular plot of ground. Find the area if each small square represents 1 sq. meter.

11.



(Fig.12(*a*)

Find the area of the triangle in Fig. 12(*a*) if each small square represents 1 sq. centimetre.

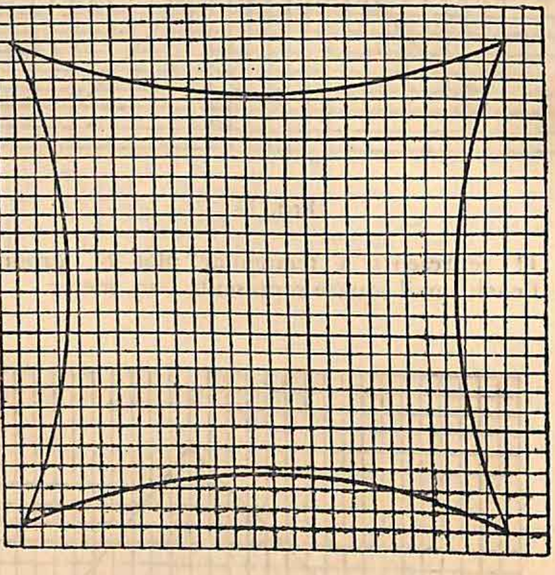


FIG. 12(*b*)

Fig. 12(*b*) represents a card table top. Count the squares and write down its area if each small square represents 1 square centimetre.

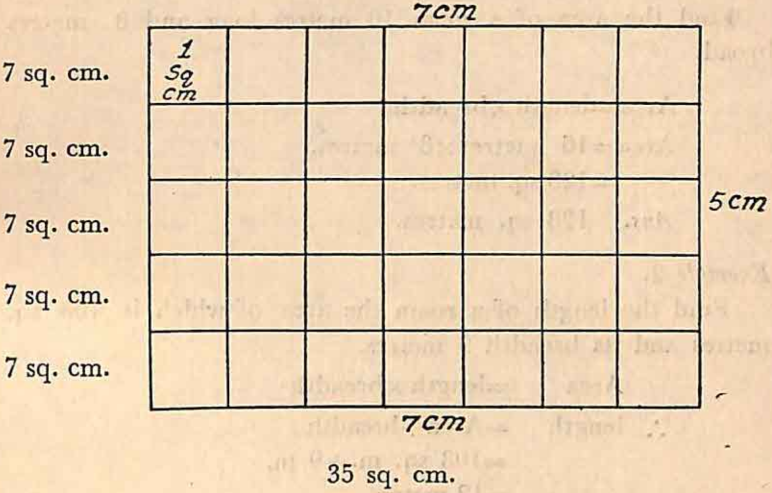


FIG. 12(*c*)

A rectangle is 7 cm. long and 5 cm. broad. If it is divided into sq. centimetres, there will be 5 rows with 7 sq. centimetres in each row. So the area is $7 \times 5 = 35$ sq. cm.

Rule. To find the area of a rectangle.

(*a*) Multiply the length in centimetres by the breadth in centimetres. The answer will be in sq. centimetres.

(*b*) Multiply the length in metres by the breadth in metres. The answer will be in sq. metres.

Area = length × breadth.

$A = 1 \times b$ square units as the area may be.

$\therefore\ 1 = A \div b; \qquad b = A \div 1.$

Example 1.

Find the area of a room 16 metres long and 8 metres broad.

Area = length × breadth.

Area = 16 metres × 8 metres.

= 128 sq. metres.

Ans. 128 sq. metres.

Example 2.

Find the length of a room the area of which is 108 sq. metres and its breadth 9 metres.

Area = length × breadth

∴ length = Area ÷ breadth

= 108 sq. m. ÷ 9 m.

= 12 metres.

Ans. 12 metres.

Learn these tables of sq. measure :

100 sq. millimetres = 1 sq. centimetres (sq. cm.)
100 sq. centimetres = 1 sq. dicimetre (sq. dm.)
100 sq. dicimetres = 1 sq. metre (sq. m.)

Exercises 44

1. Find the area of a square of side 15 millimetres Give your answer (*a*) in sq. millimetres (*b*) in sq. cm. and sq. m.

2. Find the area of a square of 10 cm. side. Give your answer (*a*) in sq. centimetres (*b*) in sq. decimetres.

3. Find the area of a square of side 15 metres.

4. A field is 25 metres long and 18 metres wide. Find the area of the field.

5. What is the length of a field if its area is 432 sq. metres and its breadth 18 metres ?

6. What is the breadth of a gymnasium if its area is 325 sq. metres and its length is 13 metres ?

7. Find the length of a rectangular cardboard if its area is 84 sq. cm. and its breadth is 6 cm.

8. A photographic film is 16 mm. long and 12 mm. wide. Find its area (*a*) in square millimetres (*b*) in sq. centimetres and sq. metres.

9. A piece of wood is 15 mm. wide and 82 cm. long. Find its size in sq. millimetres.

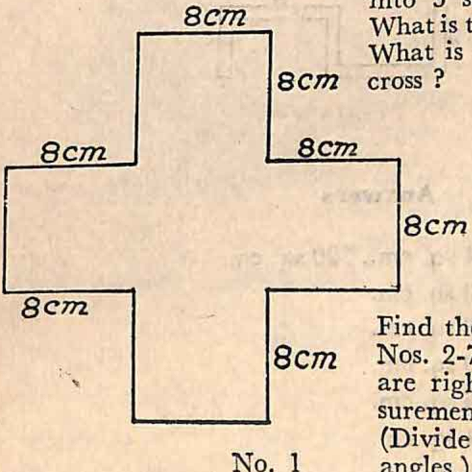
10. A rectangular table is 125 cm. long and 75 cm. wide. Find its area in sq. metres and sq. centimetres.

11. A calendar is 5 cm. wide and its area is 2790 sq. cm. Find the length of the calendar if it is a rectangle.

12. A rectangular field is 64 metres long and its area is 3008 sq. metres. Find the length of fencing required to fence the field all round.

Area : Harder Examples

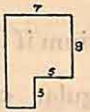
How can the cross be divided into 5 squares of equal size ? What is the area of each square ? What is the area of the whole cross ?



No. 1

Find the areas of the figures in Nos. 2-7, where all the corners are right-angled and the measurements given in centimetres. (Divide the figures into rectangles.)

No. 2



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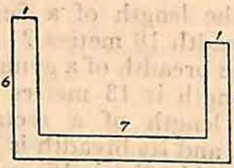
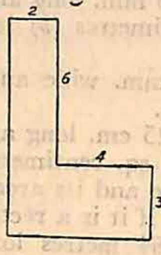


No: 4



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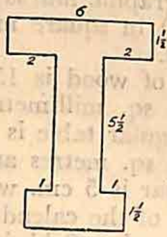

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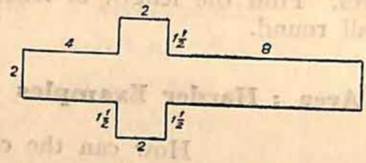
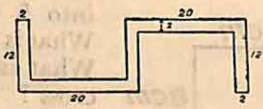


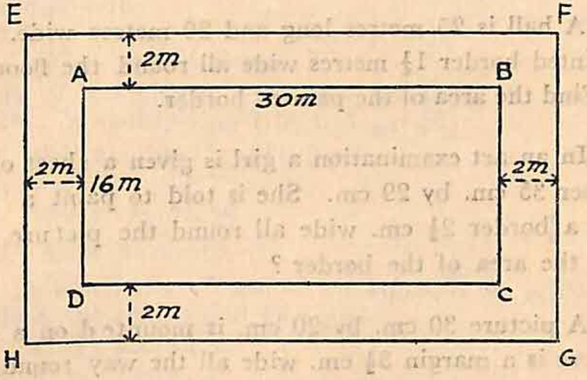
No. 7



Answers

1. 64 sq. cm., 320 sq. cm.
2. 62 sq. cm.
3. 18 sq. cm.
4. 30 sq. cm.
5. 26 sq. cm.
6. 34 sq. cm.
7. 136 sq. cm.

Example. A lawn 30 metres long, 16 metres wide, is surrounded by a path 2 metres wide. Find the area of the path.



ABCD represents the rectangular lawn and *EFGH* the OUTER edge of the path.

Now $AB=30$ metres and the path is 2 metres wide.

$\therefore$ $EF=(30+2+2)$ m. $=34$ metres.

So $EH=(16+2+2)$ m. $=20$ metres.

$\therefore$ Area of $EFGH=34\times20=680$ sq. metres.

and Area of $ABCD=30\times16=480$ sq. metres.

$\therefore$ Area of path $=$area $EFGH$—Area $ABCD$

$=680$—480 sq. metres.

$=200$ sq. metres.

This method is known as "subtraction method".

Exercises 45

1. A lawn 20 metres long, 15 metres wide is surrounded by a path 2 metres wide. Find the area of the path.

(Hint. Draw a diagram before working the problem).

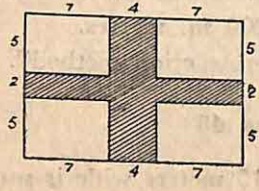
2. A wooden picture frame is 19 cm. long and 11 cm. wide and the wood 2 cm. wide. Find the area of the picture space.

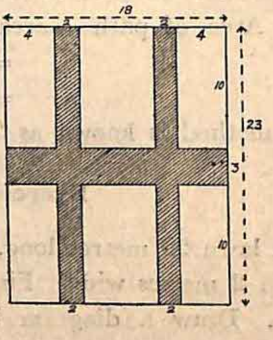
3. A hall is 25 metres long and 20 metres wide. There is a painted border 1¼ metres wide all round the floor of the hall. Find the area of the painted border.

4. In an art examination a girl is given a sheet of drawing paper 35 cm. by 29 cm. She is told to paint a picture leaving a border 2½ cm. wide all round the picture. What will be the area of the border ?

5. A picture 30 cm. by 20 cm. is mounted on a card so that there is a margin 3½ cm. wide all the way round. Find the area of the margin.

6. Find the area of the shaded parts in the following figures. All measurements are in centimetres. Use the "Subtraction method".





Example 1. What is x if $x+5=13$?

I think of a number, then add 5 and the result is 13. By adding 8 to 5 I get 13. So the number is $13-5=8$.

$$\therefore x=8$$

Check $8+5=13$

Example 2.

What is x if $8x=56$?

I think of a number; then multiply it by 8, and the result is 56. By multiplying 7 by 8, I get 56;

$\therefore$ the number is $56\div8=7$

$\therefore x=7$

Check $8\times7=56$

Example 3. Solve $x-5=13$.

Since the numbers $x-5$ and 13 are equal, if we ADD 5 to each of them the results will be equal.

$$\therefore x-5+5=13+5$$
$$\therefore x=18$$

Example 4. Solve $x+5=13$.

Since the numbers $x+5$ and 13 are equal, if we SUBTRACT 5 from each of them the results will be equal.

$$\therefore x+5-5=13-5$$
$$\therefore x=8$$

Example 5. Solve $9x=72$.

Since the numbers $9x$ and 72 are equal, if we **DIVIDE** each number by 9, the results will be equal.

$$\therefore 9x\div9=72\div9$$
$$\therefore x=8$$

Example 6. Solve $\frac{y}{4}=24$.

Since the numbers $\frac{y}{4}$ and 24 are equal, if we **MULTIPLY** each number by 4, the results will be equal.

$$\therefore \frac{y}{4}\times4=24\times4$$
$$\therefore y=96$$

There are four arguments used in the last four examples worked out. We must use one or more of these arguments to solve simple equations.

The arguments are as follows :

- (*i*) Equal numbers may be added to each side.
- (*ii*) Equal numbers may be subtracted from each side.
- (*iii*) Each side may be multipled by equal numbers.
- (*iv*) Each side may be divided by equal numbers.

Exercises 46

1. Find x in the following :—Use the "think of a number" method. :

(*a*) $27+x=45$
(*b*) $27-x=2$
(*c*) $42+x=71$
(*d*) $42-x=17$
(*e*) $x-15=31$
(*f*) $x+15=45$
(*g*) $x-12=27$
(*h*) $x+12=56$

2. Find x in the following :—Use the "think of a number" method :

(*a*) $8x=72$
(*b*) $7x=63$
(*c*) $9x=144$
(*d*) $12x=192$
(*e*) $x\div 6=8$
(*f*) $x\div 9=6$
(*g*) $x\div 7=11$
(*h*) $x\div 12=9$
(*i*) $x\div 16=7$
(*j*) $x\div 13=3$
(*k*) $x\div 5=15$
(*l*) $x\div 16=12$

3. Find the value of x in the following :

(*a*) $2x+5=25$
(*b*) $2x-5=25$
(*c*) $3x+7=46$
(*d*) $3x-7=20$
(*e*) $5x+11=46$
(*f*) $5x-11=24$
(*g*) $12x+5=113$
(*h*) $11x-9=112$
(*i*) $9x-27=162$
(*j*) $13x+47=216$
(*k*) $16x+37=393$
(*l*) $16x-37=203$

Find the value of x in the following :

(a) $3x+5=7-x$
(b) $7x+2=12+2x$
(c) $4x+3=3x+7$
(d) $5x+3=x+19$
(e) $8x-17=2x+13$
(f) $8x+25=49-4x$
(g) $9x-49=49+2x$
(h) $7x-35=75+9x$
(i) $12x-67=41+3x$
(j) $13x+45=141-3x$
(k) $15x+22=85-8x$

5. Solve the equations :

(1) $3a=27$
(2) $5b+7=32$
(3) $4m-7=21$
(4) $4y-y=36$
(5) $8x=0$
(6) $\frac{x}{4}=36$
(7) $\frac{z}{5}=21$
(8) $x+1\frac{1}{2}=3$
(9) $n-3\frac{1}{2}=4$
(10) $M-7=11$
(11) $3k-2=10$
(12) $3p-\mathrm{p}=42$
(13) $\frac{r}{5}=15$
(14) $\frac{r+2}{5}=12$
(15) $\frac{r}{5}+2=17$
(16) $p-5=0$
(17) $5x=0$
(18) $\frac{3x}{5}=1$
(19) $\frac{1}{8}p=4$
(20) $5L+2=77$
(21) $\frac{n}{3}=\frac{2}{5}$
(22) $\frac{5t}{7}=\frac{1}{5}$
(23) $7=x+3$
(24) $8=p-5$
(25) $25=7x+4$
(26) $25=8x-7$
(27) $9x+8=20$
(28) $\frac{t}{3}+2=5$
(29) $\frac{m}{4}-5=11$
(30) $\frac{5x}{3}-3=7$

PART II

PRACTICAL GEOMETRY

The Protractor

The direction or angle between any two straight lines, such as VA and VB in Fig. 13, is measured in parts of a right angle. Just as a foot is divided up into smaller parts called inches, or an inch is divided up into tenths, so a right angle is divided up into smaller parts.

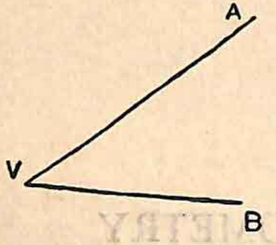


Fig. 13

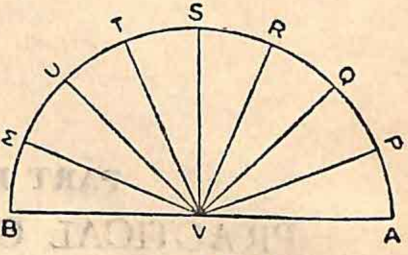


Fig. 14

Fig. 14 shows two right angles divided up into 8 equal parts. Take a sheet of tracing paper large enough to draw on it a semi-circle of radius 2 in. Draw the semi-circle and cut it out. Then fold and crease it to get the lines VP, VQ, etc. The angle PVA (written $\angle PVA) = \frac{1}{2}$ rt. angle.

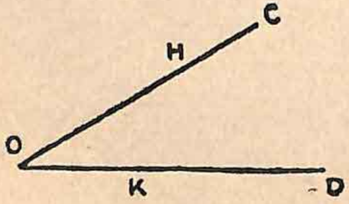


Fig. 15

What parts of a rt. angle are $\angle QVA$, $\angle SVR$, $\angle UVS$, SVP in Fig. 14?

Take up your tracing and place it on Fig. 15 so that VA falls along OD. Between what lines does OC lie? Notice that $\angle COD$ is greater than $\frac{1}{4}$ rt. angle, but less than $\frac{1}{2}$ rt. angle.

We can measure angles much more accurately by dividing up the right angle into smaller parts. Fig. 16

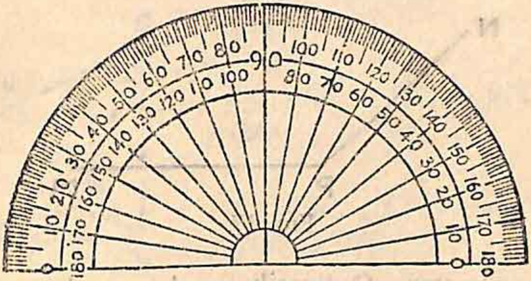


Fig. 16

shows a right angle divided up into 90 equal parts. Each part is called a **degree.**

We have then 90° = 1 rt. angle.

(Notice how we write degrees. 67 degrees would be written as 67°.)

Trace ∠*AVB* of Fig. 13 and place the tracing on Fig. 14 so that the two *Vs* come together and so that *VB* falls along the right-hand edge. Read through the tracing paper the measurement of ∠*AVB*.

Take a tracing of ∠*NPM* in Fig. 17 and measure it the same way.

Fig. 16 shows a **protractor.** It is used for measuring angles and is usually made either of metal or transparent celluloid or plastic.

Teacher will give you a protractor and show you how to use it.

In measuring the angles of Figs. 13 and 17, you will remember we took tracings of them and placed the tracing over the protractor. Ordinarily we do not place the angle over the protractor, but the protractor over the angle.

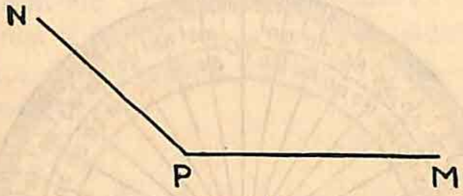


Fig. 17

Sometimes the arms of an angle are not long enough for the measurement of the angle to be read on the protractor. You will see the difficulty, if you try measuring the angles in Fig. 18. What we must do then is to make the arms longer.

An angle is not changed when its arms are made longer or shorter. Look at Fig. 15. $\angle HOK$ is the same angle as $\angle COD$.

Can the angle *BAP* in Fig. 18 be named in another way? Can the angle of Fig. 15 be named *COK* ? Can it be named *DOH*?

Can $\angle BPC$ in Fig. 18 be also named *CPB*? Can it be named *BCP* ?

Remember in naming an angle that the middle letter must stand for the vertex.

Can two angles have the same vertex ? Name some angles in Fig. 18, which have *P* for their vertex.

Can two angles have an arm in common ? In fig. 18 name two angles which have *BC* for one arm.

Exercises 47

Trace Fig. 18. Then, after making the arms long enough, measure the following angles :

$\angle APK$, $\angle KPB$, $\angle BPC$, $\angle APB$, $\angle DPK$, $\angle APD$.

$\angle KAP$, $\angle KBP$, $\angle DPC$, $\angle BCP$, $\angle KPC$, $\angle BPC$.

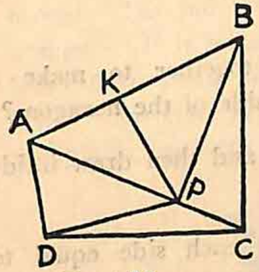


FIG. 18

Notice how an angle is named. The letter for the vertex (or meeting point of the arms) is always put in the middle.

The six-sided figure *ABCDEF* of Fig. 19 is called a **regular hexagon.** It can be drawn in either of two ways :

(*a*) Draw a circle centre *O* (one of radius 5 cm. will do). Take a radius *OA*. Then draw the other radii each making an angle of 60° with the radius next to it. How many degrees do all the six angles at *O* together equal to ?

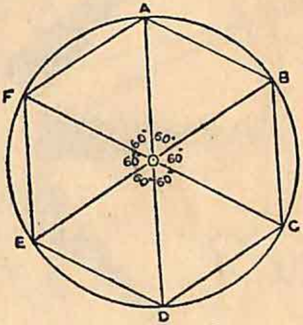


FIG. 19

(*b*) Draw a circle centre *O* (take a different radius from example (*a*)]. Now with your compasses start from *A* and go round stepping off parts equal to the radius. You will thus get the points *B*, *C*, *D*, *E*, *F*. Join them. What kind of triangles are *OAB*, *OCD*, etc. ?

Exercises 48

1. Draw an equilateral triangle of side 4 cm on paper. Cut it out. Use it as a guide to cut out five more exactly the same size.

Put the six equilateral triangles together to make a hexagon. What is the length of each side of the hexagon ?

2. Draw a circle of radius 4 cm. and then draw inside it a regular hexagon.

3. Draw a regular hexagon with each side equal to 5 cm.

You are given below a diagram of the Mariner's Compass. The Mariner's Compass is used for finding directions. In the diagram the needle or pointer is not shown. The pointer swings on a pivot at the centre of the compass. It is made of magnetised steel or iron, and, if is allowed to swing freely, it will come to rest pointing due *north*. The mariner, or the traveller, or whoever is using the compass, then turns the compass dial round till the north line

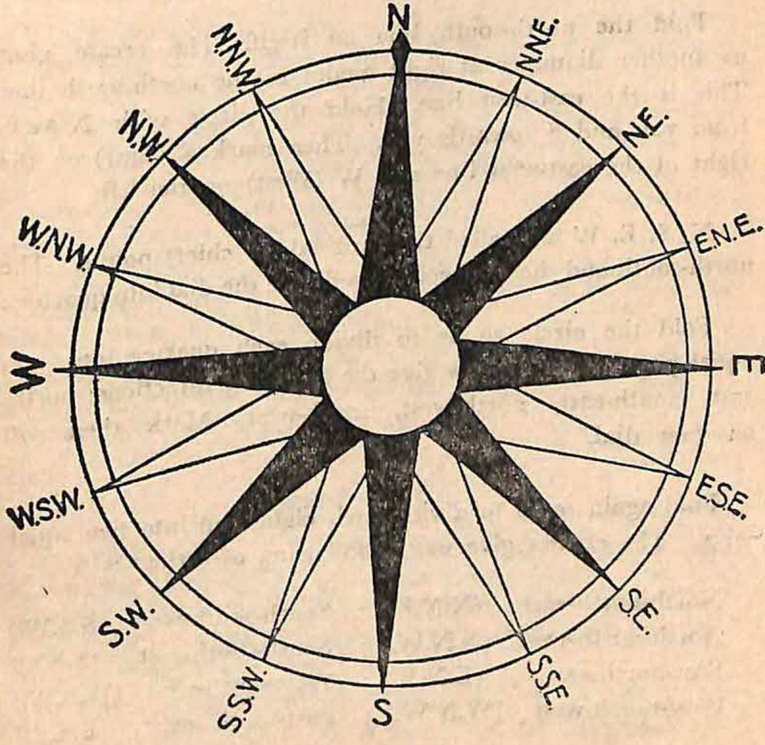


FIG. 20

of the dial comes directly under the pointer. The dial then shows all the other directions at the same time.

On a sheet of stiff paper draw a circle of 3 in. radius, and cut it out.

Fold the circle in halves. The crease gives us a diameter. Mark the ends of this diameter North (N) and South (S). The diameter itself we shall call the north-south line.

Fold the north-south line on itself. The crease gives us another diameter at right angles to the north-south line. This is the east-west line. Hold the circle with N away from you and S towards you. Then mark E (East) on the right of the east-west line and W (West) on the left.

N, S, E, W are called the cardinal (or chief) points. The north-south and the east-west lines divide the dial into quarters.

Fold the circle so as to divide each quarter into two equal parts. The creases give the following directions: north-east, south-east, north-west, south-west. Mark them off on your dial.

Fold again so as to divide each eighth up into two equal parts. The creases give us the following directions :

North-north-east	(N.N.E.) ;	South-south-west	(S.S.W.)
North-north-west	(N.N.W.) ;	South-south-east	(S.S.E.)
East-north-east	(E.N.E.) ;	West-south-west	(W.S.W.)
West-north-west	(W.N.W.) ;	East-south-east	(E.S.E.)

Mark these on your dial.

Addition and Subtraction

Exercises 49

1. Mark a point O on your paper and through it draw a straight line to represent the North-South line.

   Two men start from O. One walks $2\frac{1}{2}$ Km. North, the other walks 4 Km. South. Mark the positions of these men. How far apart are they ? Scale 1 cm. to 1 Km.

2. In question 1, suppose both men walked north, one $2\frac{1}{2}$ Km. and the other 4 Km. Mark their positions and measure the distances between them.

3. Draw a line AB 9 cm. long to represent a straight road. A and B are two towns 9 Km. apart. Mark the position of an inn $2\frac{1}{2}$ Km. away from A in the direction of B and a bridge G $1\frac{1}{2}$ Km. away from B in the direction of A. How far is the inn from the bridge ?

4. In question 3 mark the position of a man M, who has walked 3 Km. from A towards B. How far is he from the bridge ? How far is he from the inn ?

5. Q and Y are two towns 12 Km. apart on a straight road. A man walks $5\frac{1}{2}$ Km. from X towards Y. How far apart are the two people ?

Exercises 50

1. Mark a point O on your paper and through it draw two straight lines OX and OY to point North and East respectively. Two men start from O, one walks 6 Km. North and the other walks 8 Km. East. How far apart are they now ? (Scale 1 cm. $=$1 Km.)

2. Two men start from O. One walks 5 Km. West and the other 12 Km. South. How far apart are they now ?

3. A man starts from O and walks 8 Km. North, then turns and walks 6 Km. East. How far is he from O ?

4. A man starts from *O* and walks 15 Km. South, then 5 Km. West, and then 3 Km. North again. How far is he from *O* ?

5. A man driving a car starts from *O* and travels 12 Km. East, then 20 Km. North, then 4 Km. West, then 5 Km. South. How far is he now from his starting point ?

6. A cyclist starts from *O* and travels 18 Km. North, then 10 Km. West, then 6 Km. South and finally 5 Km. East. How far is he from his starting point ? (2 cm=1 Km.)

7. Two cyclists start from *O*. One travels 6 Km. N. E., and the other 8 Km. S.W. How far apart are they ?

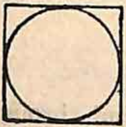
8. Two motorists start from *O*. One travels 7 Km., N.W. and the other 6 Km. S.E. How far apart are they ?

9. Two trains start from a station *O*. One travels 60 Km. N.E. and the other 80 Km. S.E. What is the angle between their two directions ? How far apart are they ? (Scale 1 cm.=10 Km.)

10. Two trains start from a station *O*. One travels 15 Km. S.W., and the other 20 Km. S.E. How far apart are they ? (Scale 1 cm.=5 Km.)

Exercises 51

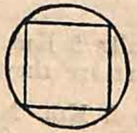
FIG. 21



1. Draw a square of side 6·5 cm. Draw the circle that touches all 4 sides ? See Fig. 21.

2. Draw a square of side 7·2 cm. Draw the circle that passes through the four vertices (corners). See Fig. 22.

FIG. 22



3. Pins are stuck 1 cm. apart along the sides of a square of side 5 cm. How many pins are there ?

4. Draw square of perimeter 24 cm.

5. Draw a rectangle length 7 cm. and perimeter 24 cm. Measure the diagonals.

6. Draw a rectangle 6½ cm. by 4½ cm. Can you draw a circle to touch the four sides ? Give your reason.

7. Draw a circle of 5 cm. radius. In it draw a rectangle with one side 6·5 cm. Measure the other side.

8. Draw a rectangle breadth 4½ cm. and perimeter 22 cm. Measure the diagonals.

Perpendiculars

Distance of a point from a line

One straight line is said to be **perpendicular** to another straight line when the angle between them is a right angle.

Point out pairs of perpendiculars (perpendicular lines) in your classroom. (Look at the edges of your desk, of your books, the walls, etc.)

To drop a perpendicular from a point on a line

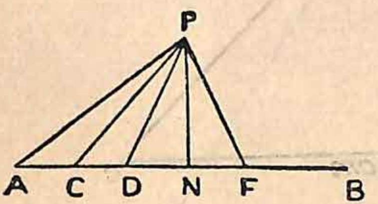


FIG. 23

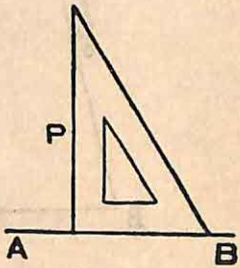


FIG. 24

In Fig. 23 *P* is a point on the floor of a room and *AB* is the edge of a wall. How far is *P* from *AB* ?

4. A man starts from O and walks 15 Km. South, then 5 Km. West, and then 3 Km. North again. How far is he from O?

5. A man driving a car starts from O and travels 12 Km. East, then 20 Km. North, then 4 Km. West, then 5 Km. South. How far is he now from his starting point?

6. A cyclist starts from O and travels 18 Km. North, then 10 Km. West, then 6 Km. South and finally 5 Km. East. How far is he from his starting point? (2 cm=1 Km.)

7. Two cyclists start from O. One travels 6 Km. N. E., and the other 8 Km. S.W. How far apart are they?

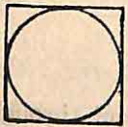
8. Two motorists start from O. One travels 7 Km., N.W. and the other 6 Km. S.E. How far apart are they?

9. Two trains start from a station O. One travels 60 Km. N.E. and the other 80 Km. S.E. What is the angle between their two directions? How far apart are they? (Scale 1 cm.=10 Km.)

10. Two trains start from a station O. One travels 15 Km. S.W., and the other 20 Km. S.E. How far apart are they? (Scale 1 cm.=5 Km.)

Exercises 51

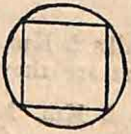
FIG. 21



1. Draw a square of side 6·5 cm. Draw the circle that touches all 4 sides? See Fig. 21.

2. Draw a square of side 7·2 cm. Draw the circle that passes through the four vertices (corners). See Fig. 22.

FIG. 22



3. Pins are stuck 1 cm. apart along the sides of a square of side 5 cm. How many pins are there?

4. Draw square of perimeter 24 cm.

5. Draw a rectangle length 7 cm. and perimeter 24 cm. Measure the diagonals.

6. Draw a rectangle $6\frac{1}{2}$ cm. by $4\frac{1}{2}$ cm. Can you draw a circle to touch the four sides ? Give your reason.

7. Draw a circle of 5 cm. radius. In it draw a rectangle with one side 6·5 cm. Measure the other side.

8. Draw a rectangle breadth $4\frac{1}{2}$ cm. and perimeter 22 cm. Measure the diagonals.

Perpendiculars

Distance of a point from a line

One straight line is said to be **perpendicular** to another straight line when the angle between them is a right angle.

Point out pairs of perpendiculars (perpendicular lines) in your classroom. (Look at the edges of your desk, of your books, the walls, etc.)

To drop a perpendicular from a point on a line

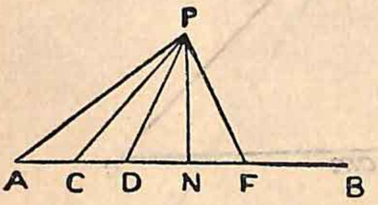


FIG. 23

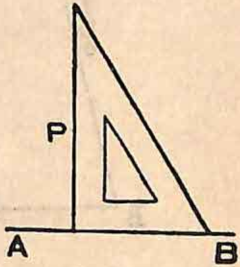


FIG. 24

In Fig. 23 P is a point on the floor of a room and AB is the edge of a wall. How far is P from AB ?

PC, *PD*, *PN*, *PF* are straight lines drawn from *P* to *AB*. Which of these lines measures the distance from *P* to *AB* ?

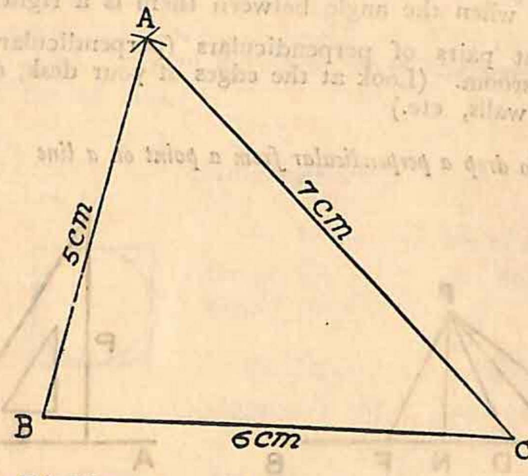
When we speak of the distance of a point from a straight line, we mean the *perpendicular* distance. *PN* is, therefore, the distance of *P* from *AB*.

To measure the distance of a straight line

We first drop a perpendicular from the point on the line. Fig. 24 shows how this is done with a set square. The set square is placed so that one edge lies along *AB* and the other edge passes through *P*. The perpendicular is drawn along the latter edge.

To construct a triangle, given the length of its 3 sides.

Example : Using ruler and compasses construct the triangle *ABC*, given that $AB = 5$ cm. ; $BC = 6$ cm. ; $CA = 7$ cm.



Draw *BC* 6 cm. long. With *B* as centre and 5 cm. as radius draw an arc of a circle. With *C* as centre and 7 cm. as radius draw another arc to cut the first at *A*. Then *A* is the third vertex of the triangle *ABC*. Join *AB* and *AC*. *ABC* is the required triangle.

When we draw the arc with B as centre and 5 cm. radius we do this because all points 5 cm. away from B lie on this circle. In the same way all points 7 cm. away from C lie on a circle, centre C and radius 7 cm. To find A we draw arcs of these two circles which will cut one another. These arcs cut at A, so A is 5 cm. from B and 7 cm. from C.

Exercises 52

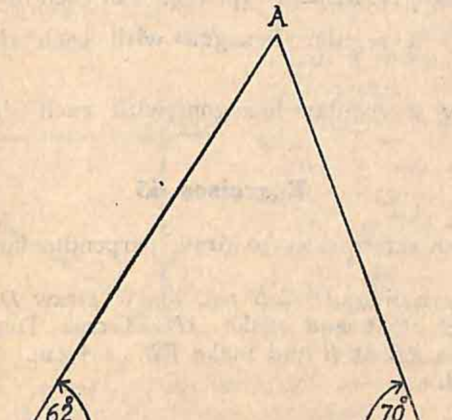
1. Using your ruler and compasses draw these triangles and name them. Measure the angles of each triangle.

(*a*) AB = 5 cm. ; BC =7·5 cm. ; CA =8·2 cm.
(*b*) PQ =8·2 cm. ; QR;=9·1 cm. ; RP =9·7 cm.
(*c*) XY =5·7 cm. ; YZ =7·1 cm. ; ZX =6·6 cm.

2. Construct the equilateral triangle ABC of side 5.7 cm. Measure the angles and find the perimeter of the triangle.

3. Construct an isosceles triangles QYZ in which $XY = XZ = 7{\cdot}2$ cm. and $YZ = 4{\cdot}9$ cm. Measure the angles and find the perimeter of the triangle.

Example : Draw a triangle ABC given that $BC=5$ cm., angle $B=62°$, $\angle C=70°$.



Method : Draw the line $BC=5$ cm. Using your protractor make an angle of 62° at B and 70° at C. Produce the sides to meet at A. Then ABC is the required triangle.

4. Construct the $\triangle\ ABC$ given that :
    (*a*) $BC = 6$ cm., angle $B = 47°$, angle $C = 51°$.
    (*b*) $AB = 4{\cdot}5$ cm., angle $A = 55°$, angle $B = 61°$.
    (*c*) $CA = 5{\cdot}1$ cm., angle $C = 47°$, angle $A = 54°$.
    (*d*) $BC = 5$ cm., angle $B = 30°$, angle $C = 60°$.
    (*e*) $AB = 6{\cdot}8$ cm., angle $A = 60°$, angle $B = 60°$.

Measure the remaining sides and angle in each case.

5. Draw a circle of 4 cm. radius, and inscribe a regular hexagon. Measure the sides and angles of the hexagon.

6. Draw a circle of 4.5 cm. radius and inscribe a regular hexagon. Measure the sides and angles.

7. Draw a rectangle length 6·7 cm. and breadth 4·9 cm Draw one of the diagonals. How many triangles are there in the rectangle ? Measure the angles of each of the triangles.

8. Draw a regular hexagon with each side equal to 4·5 cm.

9. Draw a regular hexagon with each side equal to 5 cm.

Exercises 53

N.B. Use set squares to draw perpendiculars.

1. Draw a line AB 5·5 cm. long. Draw DA perpendicular to AB at A and make $AD=3$ cm Draw EB perpendicular to AB at B and make $EB = 4$ cm. Measure the distance DB.

2. Draw a line AB 6 cm. long Find a point C which is 4·5 cm. from A and 5·6 cm from B. Join CA and CB.

Draw a perpendicular from C to AB and measure this perpendicular.

3. Draw the triangle ABC, given that $AB = 7$ cm., $BC = 8$ cm ; and $CA = 9\cdot5$ cm. Find the distance of C from AB.

4. Draw the triangle ABC, given that $AB=6\cdot5$ cm.; $BC = 7\cdot5$ cm. ; $CA = 9\cdot2$ cm. Find the distance of C from AB, and B from AC.

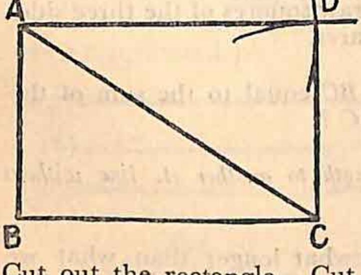
5. Draw the triangle ABC, given that $AB = BC = CA = 7\cdot2$ cm. Find the lengths of the perpendiculars drawn from each vertex to the opposite side. What do you discover about these perpendiculars ?

6. Draw a rectangle $ABCD$, given $AB = 7$ cm., $BC = 5$ cm. Draw the diagonal AC. Find how far the other vertices of the rectangle are from the diagonal AC.

7. Draw a square $ABCD$ of side 8 cm. Join BD. What is the distance of C from BD ? What is the distance of A from BD ?

Right-Angled Triangles

A triangle which has one of its angles a right angle is called a right-angled triangle. Every right-angled triangle is half a rectangle. Draw a right-angled triangle ABC with $\angle B$ a rt. $\angle$, $AB=5$ cm. and $BC = 7$ cm. With centre A and radius $= BC$, strike an arc. With centre C and radius $= BA$, strike another arc. Name the point where the arcs cut D. Join AD and CD. Then the rectangle $ABCD$ is twice the right-angled triangle. Cut out the rectangle. Cut along AC and separate the two triangles. Put one triangle on the other to see if they are exactly alike.



What is the area of the right-angled triangle *ABC* ? First think of the area of the rectangle before you answer.

Exercises 54

1. Draw the following right-angled triangles lettered *ABC* and *C* is the right angle in each case. Complete the rectangle in each case and write down the areas of the triangles.

(*a*) $AC = 4$ cm. ; $BC = 3$ cm.
(*b*) $AB = 7$ cm. ; $BC = 4$ cm.
(*c*) $AB = 8$ cm. ; $BC = 6$ cm.
(*d*) $BC = 4{\cdot}5$ cm. ; $AC = 8$ cm.

In each case find the perpendicular distance of *C* from *AB*.

2. Draw a right-angled triangle *ABC* right-angled at *B* and $AB = 4$ cm. $AC =$ cm.

Draw squares on *AB*, *BC* and *CA*.

What is the area of each square ?

Add the area of the square on *AB* to the area of the square on *BC*. Is your result equal to the area of the square on *AC* ?

3. Draw a right-angled triangle *ABC* right-angled at *A* and $AB = 6$ cm. $AC = 8$ cm. Draw squares of the three sides. Find the areas of the three squares.

Is the area of the square on *BC* equal to the sum of the areas of the square on *AB* and *AC* ?

To draw a st. line equal in length to another st. line without measuring it.

We first draw a st. line somewhat longer than what we think we shall need. Then we 'take off' the length of the first line with either the compasses or dividers, and cut off the required length on the new line.

To copy a triangle without actually measuring the sides.

Draw any triangle *ABC*.

Now take a line and mark off on it a length equal to *BC*. Then 'take off' the other two sides in turn on the compasses and strike the required arcs.

Exercises 55

1. Ask your neighbour to draw a triangle in your exercise book. Copy the triangle.

2. Draw a rectangle. Then copy it. (First draw a diagonal. This divides the rectangle into two triangles. Then copy the two triangles.)

3. Copy Fig. 25. Start with the triangle *A O B*. Then work round, copying one triangle at a time.

4. Use your compasses and ruler and draw twice the length of another line, without measuring it.

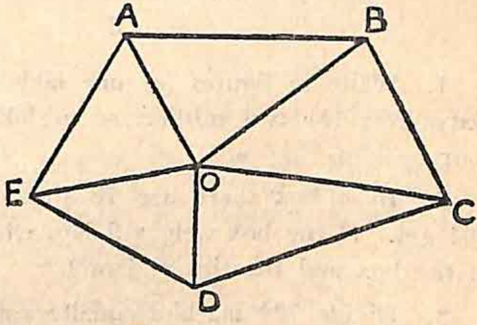


FIG. 25

5. Draw a triangle. Then draw another triangle with its sides twice the length of the first triangle. (The sides must not be measured.)

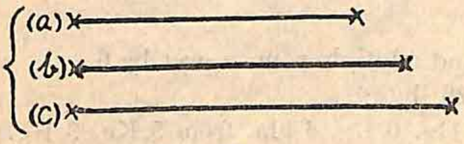


FIG. 26

6. Draw a square with its sides as long as the line (*a*).

7. Draw a rectangle with its sides equal to the lines (*a*) and (*b*).

8. Draw a triangle with its sides equal to the lines (*a*), (*b*), (*c*).

A

1. Add :
$$\begin{array}{r} 237 \\ 568 \\ 973 \\ \hline \end{array}$$

2. Subtract 387 from 921.

3. (*a*) Multiply 655 by 237.
(*b*) Divide 969 by 26.

4. I buy 9 books at Rs. 15·62 each. What did the 9 books cost ?

5. Divide 247 by 21, using factors.

B

1. Write in figures (*a*) one lakh seventy thousand and sixty five; (*b*) two million seven lakh eight hundred and four.

2. In a box there are 78 tins of jam each weighing 454 gm. If the box weighs 5 Kg. what is the total weight of the box and the tins of jam ?

3. Divide 784 marbles equally among 28 boys.

4. If 7 books cost Rs. 35, find the cost of 28 books ?

5. If a hockey stick weighs 376 gm. what is the weight of 13 hockey sticks ?

C

1. Divide 813 by 3 and multiply your answer by 6.

2. Muliply Rs. 53·28 by 4.

3. Subtract 2 Kg. 7 Hg. 6 Dg. 4 gm. from 5 Kg. 3 Hg. 2 Dg. 1 gm.

4. Multiply 3 Km. 5 Hm. 6 Dm. 4 m. by 9.

5. Find the value of $2\frac{1}{2}+3\frac{1}{4}+7\frac{3}{4}$.

D

1. Find the cost of 453 articles at Rs. 15 each.

2. Multiply 789 by 27, using factors.
Divide 497 by 15, using short division by factors.

3. Find the value of (*a*) $7+3\times5$; (*b*) $48-5\times7$; (*c*) $9\times6-3$.

4. If $a=3$, $b=4$, $c=6$, find the value of $2a+3b-c$; $3a\times b+c$; $4a+3b\times2c$.

5. If 12 men do a piece of work in 7 days, how long will 21 men take to do the same piece of work ?

E

1. Find the cost of 12 metres of silk at Rs 9·37 a metre.

2. A photographer charges Rs 4·38 for developing a roll of film and printing 8 negatives. If the developing costs Rs 1·50 what does he charge for printing each negative ?

3. Make a bill for the following :

3 metres of flannel at Rs 13·25 a metre.
$3\frac{1}{2}$ doz. buttons at Re 0·80 a dozen
$1\frac{3}{4}$ Kg of toffee at Rs 4·80 a Kg.

4. Find the value of (*a*) $\frac{1}{3}+\frac{1}{4}-\frac{1}{6}$ (*b*) $\frac{3}{7}+28$ (*c*) $\frac{4}{5}$ of 35 litres.

5. Draw a triangle *ABC* given that $AB=6{\cdot}9$ cm.; $BC=8{\cdot}1$ cm. ; $CA=7{\cdot}4$ cm.

F

1. Find the total cost of 5 pens at Rs 4·20 each and 7 propelling pencils at Rs 3·25 each.

2. Find the length of fencing required to enclose a rectangular garden 25 m. long and 18 m. 65 cm. wide.

3. How much less than 20000 is the product of 65 × 273 ?

4. A train running 18 min. late arrived at station at 10.40 a.m. At what time would it have arrived if it were running 8 minutes early ?

G

1. (*a*) Divide 37806 by 16.
   (*b*) Multiply 3571 × 34.

2. How many days are there from the 14th of June to 8th July ?

3. How many hours and minutes are there between 8.40 a.m. and 3.15 p.m. ?

4. A man cycles 24 miles in 3 hours. How long will he take to travel 18 miles ?

5. The perimeter of a rectangle is 78 metres. If the length is 21 metres, what is the breadth of the rectangle ?

H

1. Divide Rs 420 between 3 people, giving one Rs. 30 more than the others.

2. Find the missing numbers (*a*)

$$\begin{array}{r} 321* \\ +46*3 \\ +5*64 \\ +*076 \\ \hline *7148 \\ \hline \end{array} \qquad (b) \quad \begin{array}{r} 6* \\ \times * \\ \hline 512 \\ \hline \end{array}$$

3. If I had Rs 2·25 more I could just buy 9 pairs of socks at Rs 3·25 a pair. How much have I ?

4. If $a=6$, $b=7$ and $c=4$, find the value of $ab+c$, $2bc-a$, $3a+4b\times 2c$ and $2a\times(3b-4c.)$

5. Find the prime factors of (*i*) 5184; (*ii*) 11025 (*iii*) 6032.

I

1. What number multiplied by 17 gives 5253 ?
2. Find the prime factors of 6076.
3. Simplify $3\frac{3}{4}-1\frac{5}{12}+4\frac{5}{6}$.
4. What must be added to $2\frac{3}{10}+9\frac{1}{2}$ to make 15 ?
5. Draw a triangle ABC, given that $BC=7{\cdot}1$ cm, angle $B=45°$ and angle $C=59°$. Measure the remaining sides.

J

1. The product of three numbers is 4301; two of them are 11 and 17, find the third number.
2. Add together : (*a*) 3·62, 5·18; 6·04, 5·3,
   (*b*) 8·01, 9·37; 2·06, 5·8.
3. Each step of a staircase is 15 cm. high. How many steps are there if the staircase is 2 m. 25 cm. high ?
4. Find by using prime factors (*a*) the H.C.F. of 693, 1815 and (*b*) the L.C.M. of 6, 15, 25.
5. A rectangle is 8·4 cm. long and 5·8 cm. wide. Find its perimeter.

K

1. Simplify : $2\frac{5}{6}-3\frac{1}{12}+4\frac{3}{4}$.
2. Simplify : (*a*) $3\frac{1}{5}\times4$ (*b*) $5\frac{2}{7}\times28$ (*c*) $11\frac{1}{3}\times9$.
3. What is $\frac{3}{5}$ of Rs. 25·30 ?
4. Find the average of 7, 9, 12, 25, 17, 34, 50.
5. The length of a rectangle is 16 metres and its area is 208 square metres. Find its breadth.

L

1. The weight of 9 tins of sweets is 25 Kg. 227 gm. What is the average weight of each tin ?

2. Draw a circle of 4 cm. radius. Inscribe a regular hexagon *ABCDEF*. Measure the lengths of *AB*, *AD*, *AE*.

3. A room is 15 metres long and 12 metres wide. A carpet is laid down so as to leave a margin of 2 metres wide all round. Find the area of the carpet and the area of the margin.

4. Simplify : (*a*) $1\frac{1}{2}+3\frac{5}{12}-2\frac{5}{12}$. (*b*) $\frac{1}{2}+\frac{2}{3}-\frac{3}{4}+\frac{1}{6}-\frac{1}{12}$.

5. If 16 men could plough a field in 3 days, how long will 12 men take to do it ?

M

1. Write down all the prime numbers between 11 and 75.

2. Find the L.C.M. of 32, 48, 40 and 14.

3. Find the H.C.F. of 216 and 258.

4. From a piece of cloth 20 metres long three pieces measuring 5 m. 17 cm., 6 m. 7 cm., and 4 m. 95 cm. are cut off. What length remains ?

5. Solve the equations : (*a*) $3x-5=22$
(*b*) $8x+7=63$
(*c*) $9x+4=88-3x$.

N

1. Fill in the missing numbers :
219+703+418+***=1955.

2. Divide 475 marbles between Tom, John and Dick, so that John has 21 marbles more than Dick and Tom has 19 marbles more than John.

3. Find the L.C.M. and H.C.F. of 36, 48 and 300. Leave your answers in prime factors.

4. Draw a triangle *ABC* given that $AB=5{\cdot}4$ cm., angle $A=51°$, angle $B=64°$. Draw the perpendicular from *C* to *AB*, and measure its length.

5. Construct a square having a side of 6 cm. Draw a circle inside it to touch the four sides. What is the radius of this circle ?

O

1. Simplify : $7\frac{1}{3}-4\frac{1}{2}+8\frac{5}{6}-1\frac{3}{4}$.

2. Find the prime factors of $3^2 \times 15 \times 36$.

3. Find the H. C. F. and L. C. M. of 48, 84, 256 leaving your answers in prime factors.

4. Draw a rectangle *ABCD* 12 cm. long and 5 cm. wide. Draw a circle with the *AC* as diameter. Measure its radius.

5. Construct a rectangle *ABCD* with $AB=9$ cm. and $BC=5$ cm. How far is *B* from the diagonal *AC* ?

P

1. By how much does 4796 exceed 2979 ?

2. John and his younger sister are given Rs 35 to share between themselves. John takes $\frac{3}{5}$ and gives the rest of the money to his sister. How much does John's sister receive ?

3. If cricket bats are sold at Rs 27·25, how much more must I pay for 16 bats than for 13 of them ? (Do this sum by the shortest method you know.)

4. A batsman scores 27, 48, 57, 125, 3 & 64 in six completed innings. Find his batting average.

5. The following table shows the average rainfall of a town. Draw a column graph. By looking at the graph find :

Month	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
Rain fall in centimetres	12	10	12	7	5	2	3	4	9	10	11	11

(*a*) which month has the highest and which the lowest average rainfall.

(*b*) which months have an average rainfall of less than 5 centimetres.

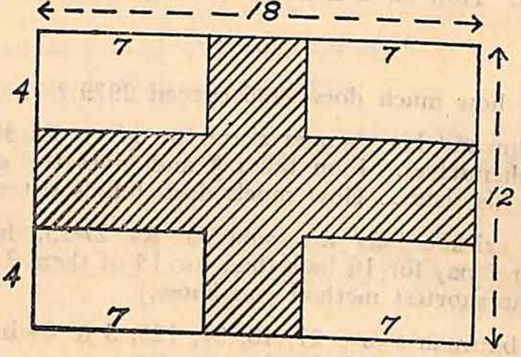
(*c*) what is the total average rainfall during the months of August to October.

(*d*) which months you think are the wettest.

Q

1. A motorist travels 40 Km. North and then 9 Km. East. Draw a diagram to scale and find how far he is from his starting point.

2. Find the area of the shaded portion in the given diagram. All measurements are in metres.



3. Solve the equations :

(*a*) $3r-15=62-8r$

(*b*) $\frac{m+4}{5}=9$

(*c*) $\frac{n}{7}-4=12$

4. In an army camp there is sufficient food to last 54 soldiers for 15 days. How long would the same quantity of food last 30 soldiers ?

5. The following table shows the monthly average temperature of Darjeeling for a certain year.

Month	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
Temp. in centigrade	6	9	14	19	22	19	18	17	16	14	10	7

Draw the graph. From the graph find :

(*i*) the warmest months.

(*ii*) the months in which the average temperature is between 6° centigrade and 11° centigrade.

(*iii*) when the schools in Darjeeling will have their long holidays.

R

1. What must be added to 218934 to give 613702 ?

2. I go to the post-office and buy 16 fifteen-naya-paisa stamps, 26 eight-naya-paisa stamps and 11 ten-naya-paisa stamps. If I give the stamp vendor two five-rupee notes what change must he return to me ?

3. What is the average of 152, 156, 152, 155, 154, 155 ?

4. If $\frac{2}{5}$ of a journey is 25 Km., what is the whole journey ?

5. If $a=7$, $b=2$, $c=3$, find the value of :

(*i*) $2a \times 3b - 4c$

(*ii*) $7a - 5b + 9c$

(*iii*) $5a \times (6c - 3b)$

(*iv*) $(12a - 5c) \times 4b$:

S

1. Express 6468 in prime factors, using the index notation.

2. A picture 20 cm. by 12 cm. is mounted on a card so that there is a margin $2\frac{1}{2}$ cm. wide all round the picture. What area of the card is uncovered ?

3. A man bought 15 carpets and sold 8 of them for Rs. 67·50 each and the remainder for Rs. 55 each. He then found he had lost Rs. 20 on the deal. How much did he pay for each carpet ?

4. There are 360 pupils in a school. If $\frac{3}{5}$ of the pupils in the school are boys, how many girls are there ?

5. Draw a circle of 4 cm. radius. Construct a rectangle inside the circle with one of its sides 5 cm. long.

T

1. (*a*) Find the value of $\frac{4}{7}$ of 3 hrs 16 min.

(*b*) Find the value of $5{\cdot}09+1{\cdot}07-3{\cdot}79$.

2. A lawn 50 metres long and 11 metres wide is surrounded by a gravel path $3\frac{1}{2}$ metres wide. Find the area of the path.

3. $\frac{2}{5}$ of John's money is equal to $\frac{1}{5}$ of Mary's. Mary has Rs. 40 how much has John ?

4. The average age of 5 women is 46, and the average of 4 of them is 43; what is the age of the fifth woman ?

5. A tank can be filled in 10 hours by 6 equal pumps working together. If the tank is filled in 15 hours, how many pumps are working together ?

ANSWERS TO EXERCISES—INDIVIDUAL WORK

Individual Work 1

A

1. 84 times 2. Rs 60·50 3. 9·28 a.m.

B

1. Yes : 33 each 2. Rs 37·23 3. 260 Kg. 925 gm.
4. 35 m.

C

1. 399861 2. Jam; 10 gm. 3. (*a*) 84 (*b*) 2532
4. (*a*) 118 Kg. 6 Dg. 4 gm.
   (*b*) 1 Kg. 9 Hg. 6 Dg. 3 gm.

D

1. (*a*) 22; rem. 16 (*b*) 7608 2. Rs 12·15
3. Rs 1775.55

E

1. 2255 2. 7 m. 49 cm. 3. Rs 2·00
4. Rs 51

F

1. (*a*) 80; 37 over (*b*) 319; 5 over 2. Re 1
3. 38; 10; 23, 7803

G

1. 44 Kg. 464 gm. 2. 148 hrs 49 min 21 sec.
3. Rs 30·60 4. 1 m. 25 cm.

Individual Work 2

A

1. 1778 2. 634 3. (*a*) 155235 (*b*) 37 rem. 7
4. Rs 1405·8 5. 11 rem. 16

B

1. 170065; 2700804 2. 40 Kg. 412 gm. 3. 28
4. Rs 140 5. 4 Kg. 888 gm.

C

1. 1626 2. Rs 213·12 3. 2 Kg. 5 Hg. 5 Dg. 7 gm.
4. 32 Kg. 7 Dm. 6 m. 5. $13\frac{1}{2}$

D

1. Rs 6795 2. (*a*) 21303; (*b*) 33 rem. 2 3. 22;
1351 4. 12; 42; 156 5. 4 days

E

1. Rs 112·44 2. 36 nP. 3. Rs 50·95 4. $\frac{5}{12}$; 12;28

F

1. Rs 43·75 2. 87·30 3. 3255 4. 10·14

G

1. 604896; 121414 2. 24 3. 6 hrs 35 min.
4. $2\frac{1}{4}$ hrs 5. 18 m.

H

1. 160, 130, 130 2. (*a*) 5, 9, 1, 4, 1; (*b*) 4, 8 3. Rs 27
4. 46; 50; 60 5. $2^6 \times 3^4$;$3^2 \times 5^2 \times 7^2$; $2^4 \times 13 \times 29$

I

1. 309   2. $2^2 \times 7 \times 31$ 3. $7\frac{1}{6}$ 4. $3\frac{1}{5}$

J

1. 23   2. 20·14; 25·24   3. 15   4. (*a*) 33;   (*b*) 150;
5. 28·4 cm.

K

1. $4\frac{1}{2}$ 2. $12\frac{4}{5}$; 148; 102   3. Rs 15·18   4. 21
5. 13 m.

L

1. 2 Kg. 803 gm.   2. 88 sq.m.; 92 sq.m.   4. (*a*) $2\frac{11}{12}$;
(*b*) $\frac{1}{8}$ 5. 4 days

M

2. 3360   3. 6   4. 3 m. 81 cm.   5. $x=9$; $x=7$;
$x=7$

N

1. 615   2. 178, 159, 138   3. L.C.M. $2^4 \times 3^2 \times 5^2$;
H.C.F. 12

O

1. $9\frac{11}{12}$ 2. $2^2 \times 3^4 \times 5$ 3. H.C.F. 2^2 L.C.M. $2^8 \times 3 \times 7$

P

1. 1997   2. Rs 14   3. Rs 81·75   4. 54

Q

1. 41   2. 104 sq.m.   3. (*a*) $r=7$; $\mathrm{m}=41$; $n=112$
4. 27

R

1. 394768 2. Rs 4·42 3. 154 4. $62\frac{1}{2}$ Km.
5. 72; 66; 420; 552

S

1. $2^2 \times 3 \times 7^2 \times 11$ 2. 185 3. Rs 63 4. 144

T

1. 1 hr 52 min. ; 2·37 2. 476 sq.m. 3. Rs 12
4. 58 yrs 5. 4.

TABLES

Length

Metric System

10 millimetres (mm.) = 1 centimetre (cm.)
10 centimetres = 1 decimetre (dm.)
10 decimetres = 1 metre (m.)
10 metres = 1 dekametre (Dm.)
10 dekametres = 1 hectometre (Hm.)
10 hectometres = 1 kilometre (Km.)
1000 mm. = 1 m. 1000 m. = 1 Km.
100 cm. = 1 m.

Capacity

100 centilitres (cl.) = 1 litre (l)

Weight

10 milligrams (mg.) = 1 centigram (cg.)
10 centigrams = 1 decigram (dg.)
10 decigrams = 1 gram (gm.)
10 grams = 1 dekagram (Dg.)
10 dekagrams = 1 hectogram (Hg).
10 hectograms = 1 kilogram (Kg.)
1000 grams = 1 kilogram
1000 kilograms = 1 metric ton or tonne.

Number

12 units = 1 dozen
12 dozen = 1 gross
20 units = 1 score.

Time

60 minutes = 1 hour (hr)
24 hours = 1 day (d.)
7 days = 1 week (wk)
14 days = 1 fortnight
365 days = 1 year (common) (yr)
366 days = 1 leap year
12 months = 1 year

"Thirty days hath September,
April, June and November.
All the rest have thirty-one,
Excepting February alone,
Which has but twenty-eight days clear,
And twenty-nine in each leap year."

Money

Indian

100 Paise = 1 Rupee (Re)

American

100 cents = 1 dollar ($)

British

4 farthings = 1 penny (*d*)
12 pence = 1 shilling (*s*.)
20 shillings = 1 pound (£1)
240 pence = 1 pound (£1)

MEASURES

Length

Inch, Foot, Yard, Chain, Furlongs, Mile.

12 in. = 1 ft
3 ft = 1 yd
22 yd = 1 ch.
10 ch. = 1 fur.
8 fur. = 1 mile

Weight (British)

Ounce, pound, stone, quarter, hundredweight(cwt.), ton.

16 oz. = 1 lb.
14 lb. = 1 st.
2 st. = 1 qr.
4 qr. = 1 cwt.
20 cwt = 1 ton.

Area

Square inch, Square foot, Square yard.

144 sq.in. = 1 sq. ft
9 sq.ft = 1 sq. yd

Indian Weight

Tola, chhattak, seer, maund.

5 tolas = 1 chtk
16 chtk = 1 sr
40 srs = 1 md

Capacity

Pint, Quart, Gallon.

2 pt = 1 qt
4 qt = 1 gall.

MULTIPLICATION TABLE

X	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**16**
1	1	2	3	4	5	6	7	8	9	10	11	12	16
2	2	4	6	8	10	12	14	16	18	20	22	24	32
3	3	6	9	12	15	18	21	24	27	30	33	36	48
4	4	8	12	16	20	24	28	32	36	40	44	48	64
5	5	10	15	20	25	30	35	40	45	50	55	60	80
6	6	12	18	24	30	36	42	48	54	60	66	72	96
7	7	14	21	28	35	42	49	56	63	70	77	84	112
8	8	16	24	32	40	48	56	64	72	80	88	96	128
9	9	18	27	36	45	54	63	72	81	90	99	108	144
10	10	20	30	40	50	60	70	80	90	100	110	120	160
11	11	22	33	44	55	66	77	88	99	110	121	132	176
12	12	24	36	48	60	72	84	96	108	120	132	144	192
16	16	32	48	64	80	96	112	128	144	160	176	192	256